

STRUCTURE OF THE MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use the microcard		1	2	3		4
A01 = Structure of microcard				SIS		
B01 = Trouble-shooting chart	A-	***X*	X*XXX	XXXXX	XXXXX	*XXXX X
	B-	*XXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	C-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	D-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	E-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XX
	F-	XXXXX	XXXXX	XXXXX	XXX	
	G-	XXXXX	XXXXX	XXXX		
	H-					
	J-					
	K-					
	L-					
	M-					
N01 = Service Information	N-	*XXXX	XXXXX	XXXXX	XXX	XX XX*
		12345	67890	12345	67890	12345 678
			1		2	

Index  
N28 = Table of contents and publication information

- 1 = Special features
- 2 = Safety and precautionary measures
- 3 = Test equipment and tools
- 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each coordinate).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

			
Beginning	Mid-section	End	One-page section

A01		=> <=
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HOW TO USE THE MICROCARD

Trouble-shooting instructions for

System: Motronic ML 5.1  
(VW designation: Digifant)

Descriptions, photos, terminal designations and special features refer to the vehicle:

\* VW Caravelle, Transporter  
with 2.1 l - fuel-injection engine  
and catalytic converter 8.85 ->

These basic instructions are detailed trouble-shooting instructions. They must not be used as vehicle-specific instructions.  
Attention! Descriptions and photos may deviate from the vehicle-specific brief instructions.  
Binding set values, terminal assignments and special features must be taken only from the vehicle-specific brief instructions!  
For brief instructions, see table-of-contents microcard KFZ-00..

A02		=> <=
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## SPECIAL FEATURES

- \* Crankshaft speed and position via magnetic pulse generator (Hall generator)  
i.e. no engine-speed and reference-mark sensor.
- \* Closed-loop idle-speed control with external control unit (not by Bosch)
- \* Lambda closed-loop control
- \* Active-carbon container for tank ventilation

## SAFETY AND PRECAUTIONARY MEASURES

Always observe safety and precautionary measures in order to avoid hazards to persons and damage to the engine, the trigger box and control unit, and the ignition system.

**CAUTION!**  
High-performance ignition system with dangerous high and low voltages!

Contact with voltage-carrying parts or terminals can be fatal (on both primary and secondary sides).

For testing the compression, disconnect pump relay in order to prevent undesired injecting of the injection valves.

Do not short-circuit ignition coil term. 1 to ground (e.g. for switching off the engine). Ignition coil and possibly control unit will be destroyed.

Never connect positive pole of battery to ignition coil term.1. Control unit will be destroyed.

If installing an alarm system, follow the installation instructions for Motronic vehicles or SIS microcard PKW 012.

Make sure that the alarm relay is not disturbed by external fields (e.g. by ignition cables), causing it to trigger incorrectly.

SAFETY AND PRECAUTIONARY MEASURES  
(continued)

Never start engine without battery being firmly connected (battery terminals bolted tight).  
Do not disconnect battery from the vehicle electrical system with the engine running.

Do not use a fast charger for starting the engine.

Render starting assistance only with a second 12 V battery and jumper cables.

Caution! Due to non-uniform requirements placed by vehicle manufacturers on electronic products, we do not recommend the use of 24 V batteries for starting assistance.

When charging the battery in the vehicle or rendering starting assistance, observe the directions given in the operating instructions of the fast charger as well as those provided by the vehicle manufacturer.

Prior to charging or fast-charging the battery, disconnect it from the vehicle electrical system.

Incorrect polarity of the supply voltage, e.g. due to incorrect connection of the battery or ignition coil, can lead to irreparable damage to a control unit.

Do not connect or disconnect the wiring harness from control units or trigger-box with the ignition switched on.

Prior to exposure to temperatures above +80°C (paint-dry installation) remove control units.

Control units must be removed before electric spot welding.

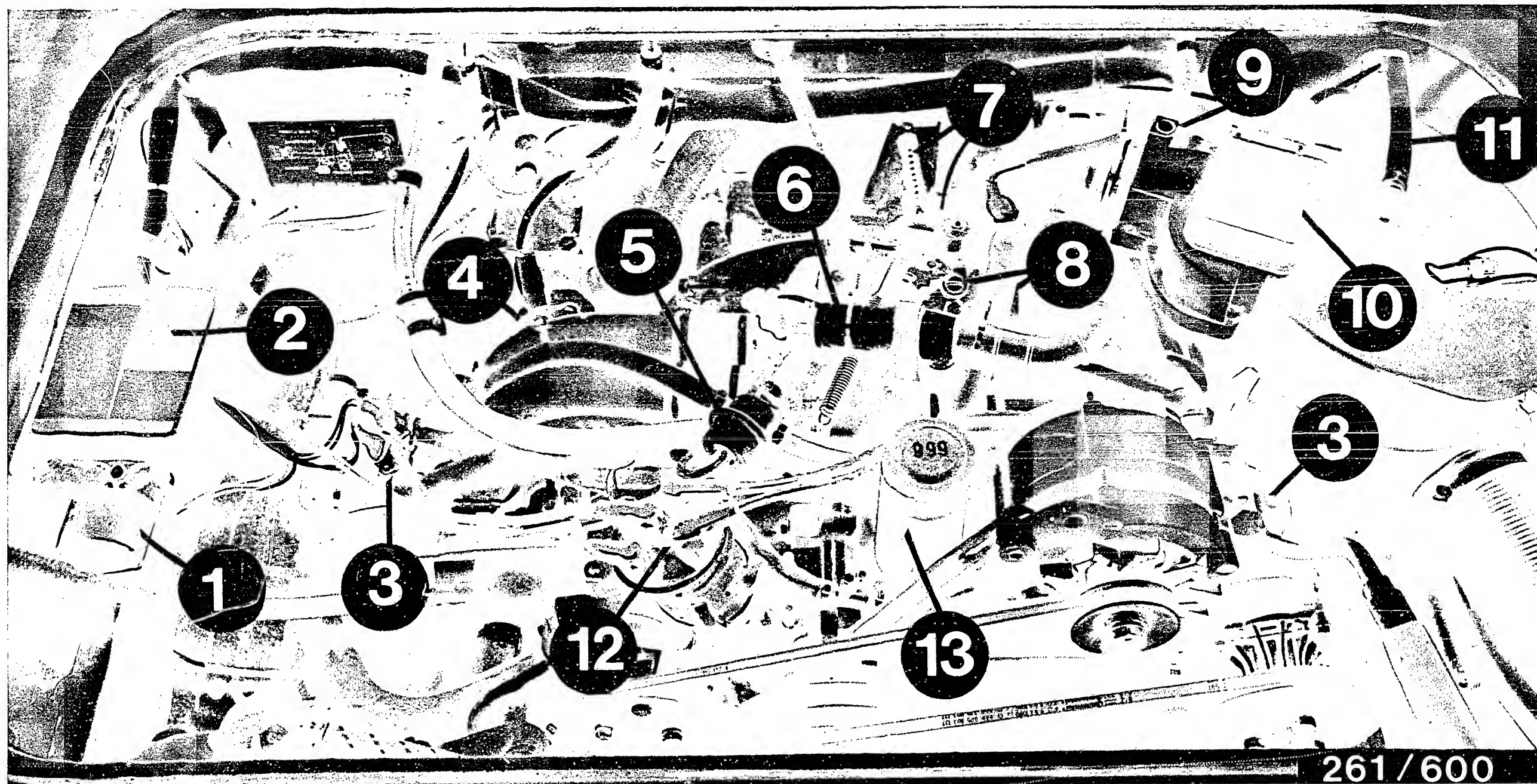
For production reasons:  
continued on the following  
coordinate.

## TEST EQUIPMENT AND TOOLS

DESCRIPTION	DESIGNATION	PART NO.
Motortester	e. g. MOT 201 MOT 300 MOT 400	0 684 000 201 0 684 000 300 0 684 000 400
Exhaust-gas analyzer	e. g. ETT 008.02 or ETT 008.03	0 684 100 802 0 684 100 803
Multimeter (internal resistance min. 20 k $\Omega$ /V)		Commercially available e.g. Metrawatt GmbH type MA2H or Fluke Multime- ter 23, 75 or 77
Pressure gauge 6 bar or Pressure tester or Pressure tester (no longer available)  Three-way line as connecting part for KDJE-P 100 and KDEP 1034	Quality class 1.0 0.1 bar divisions	1 687 231 154  KDJE-P 100  KDEP 1034  KDJE-P 100/13
Parts set		0 287 010 701

## TEST EQUIPMENT AND TOOLS (continued)

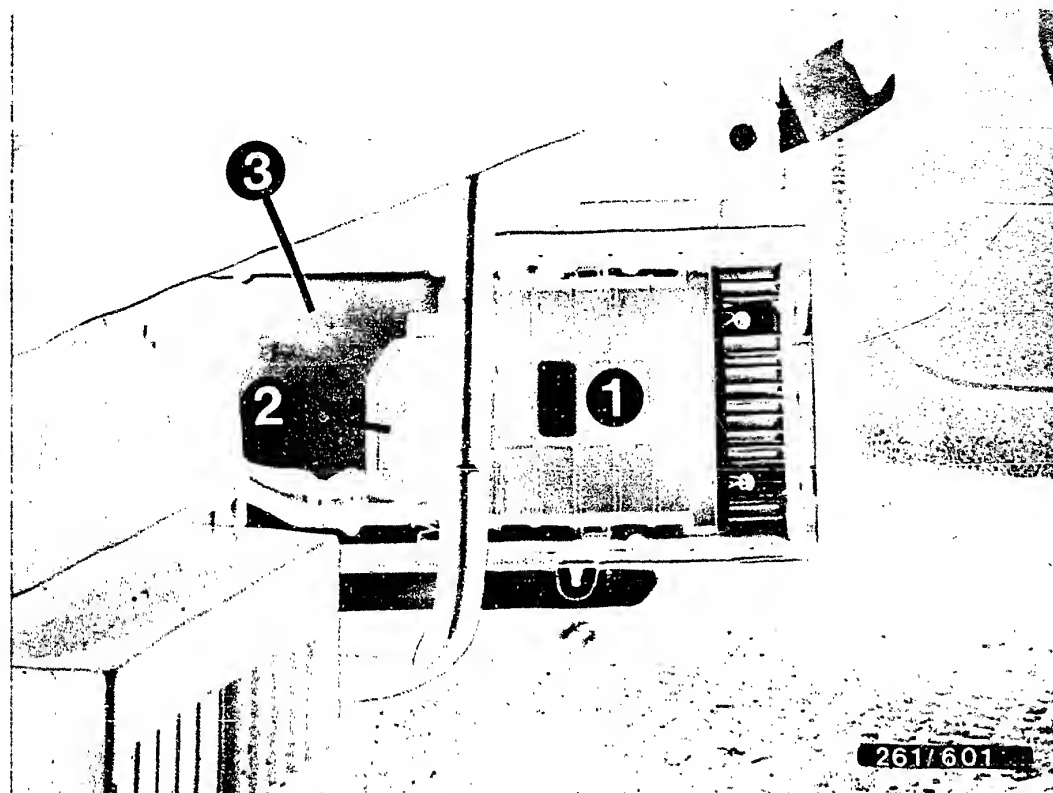
DESCRIPTION	PART NO.
Chassis dynamometer e.g. LPS 96 or LPS 002	0 680 017 001 0 680 100 200
Test lead 2-pole, for the measuring of resistances and signals e.g. at injection valves	1 684 463 093
Test leads for correct connection of test equipment at component plugs	KDZS 0004 (2.8 mm wide)  KDZS 0005 (6.3 mm wide)
Screw-on sleeve for exhaust-gas measurement upstream of catalytic converter	V.A.G. 1506
Mounting paste VS 14016 Ft for lambda sensor and exhaust-gas screw plug	5 960 080 105
Hexagon-socket-screw key A/F 5	Commercially available
Clamping fixture	1 688 120 093
Assembly mandrel	1 687 931 003
Hose clamp for pinching off fuel and air hoses	Commercially available



# INSTALLATION POSITION OF COMPONENTS

- 1 = Ignition coil
- 2 = Main and pump relays
- 3 = Injection valves
- 4 = Engine-temperature sensor
- 5 = Pressure regulator
- 6 = Idle actuator
- 7 = Throttle cable

- 8 = Idle-adjusting screw
- 9 = CO-adjusting screw
- 10 = Air-flow sensor
- 11 = Hose to active-carbon container  
(tank ventilation)
- 12 = Ignition distributor
- 13 = Oil breather

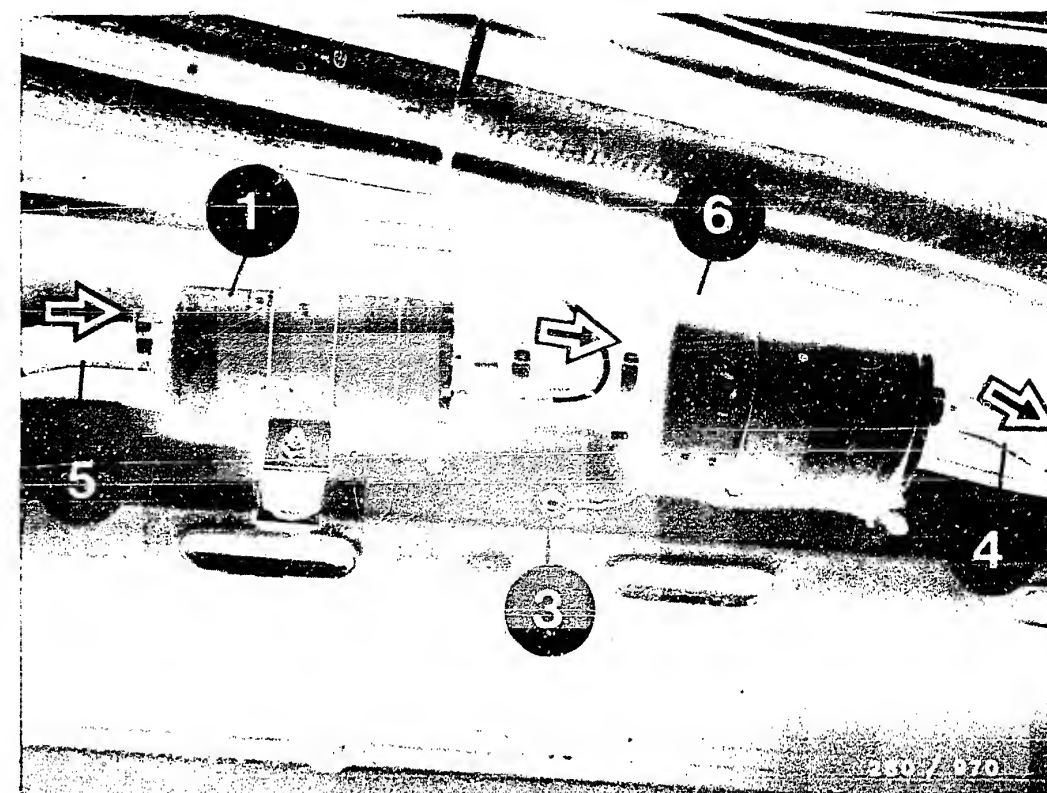


- 1 = Control unit
- 2 = 25-pole plug
- 3 = Metal cover

#### INSTALLATION POSITION OF COMPONENTS (continued)

The indications "right" and "left" refer always to the forward direction of travel.

- \* Control unit:  
Under rear-seat bench (remove footwell cover and unscrew control unit together with metal cover from floor).
- \* Fuel pump and fuel filter:  
Under vehicle (approx. center of floor).

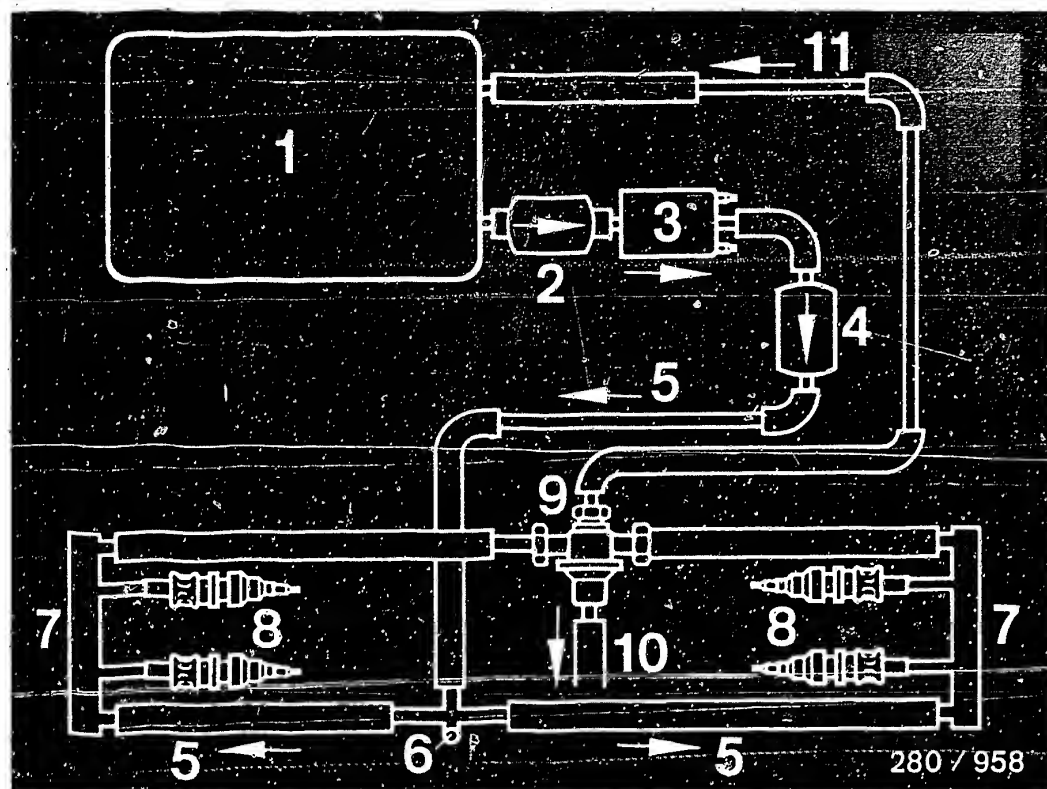


- 1 = Electric fuel pump
- 3 = Ground connection of electric fuel pump
- 4 = Fuel delivery line
- 5 = Fuel intake line
- 6 = Fuel filter
- Arrow = Direction of fuel flow

#### INSTALLATION POSITION OF COMPONENTS (cont.)

There is also a fuel-intake filter in the fuel intake line (before the electric fuel pump).

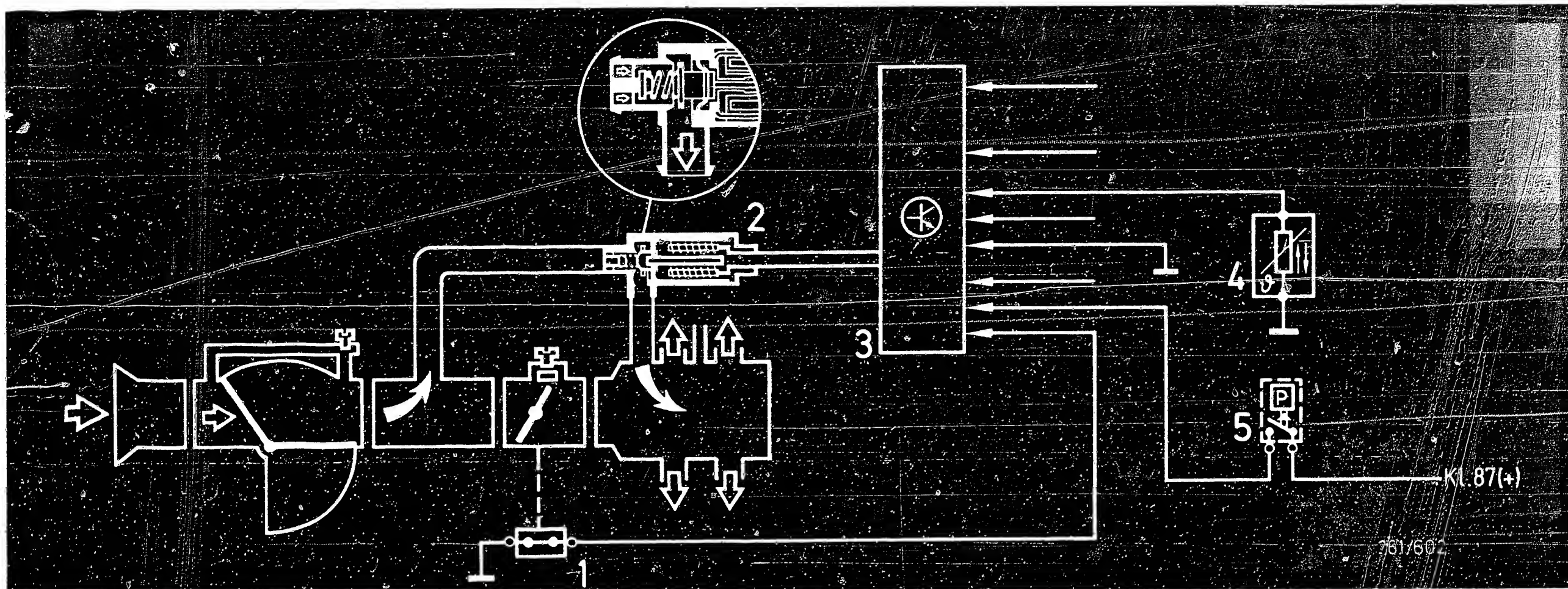




- 1 = Fuel tank
- 2 = Fuel-intake filter
- 3 = Fuel pump
- 4 = Fuel filter
- 5 = Fuel delivery line
- 6 = Connection for pressure tester
- 7 = Fuel-distribution pipe
- 8 = Solenoid-operated injection valve
- 9 = Pressure regulator
- 10 = To intake manifold
- 11 = Fuel-return line

DIAGRAM OF FUEL LINES

For production reasons:  
continued on the following  
coordinate.



1 = Idle contact  
2 = Idle actuator

3 = Idle controller  
4 = Engine-temperature sensor

5 = Pressure switch  
(power ass. steer.)

#### CLOSED-LOOP IDLE-SPEED CONTROL (non-Bosch product)

**Principle :** If the engine speed differs from the engine-speed setpoint stored in the idle controller, the idle actuator is opened or closed more or less as appropriate.

Thus, with the throttle valve closed, the air flow is regulated during idling. The instantaneous engine speed is reported from the ignition coil terminal 1.

Engine-speed comparison is performed in the control unit.

**Result :** Engine speed too low. The idle controller raises the output current for the idle actuator, which is consequently opened wider; the air-flow is increased and the air-flow sensor flap is opened. The engine speed rises.

The temperature sensor supplies the information on the operating temperature of the engine. The providers of information for engine-speed increase are: pressure switch (for power assisted steering), air conditioning switch and starter interlock switch in vehicles with automatic transmission when a driving position is selected.



## HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts on coordinate B03 and contains customer complaints (fault symptoms) with several possible causes (component faults) in each case as well as coordinate references for detailed trouble-shooting. If no coordinate reference is given, this is a cause for which no test instructions are required.

Components that are checked by the self-diagnosis or with the universal test adapter are not listed in the trouble-shooting chart.

If the customer complaint is clear, proceed with trouble-shooting in the given order of possible causes one after the other and step by step.

Always start trouble-shooting with the self-diagnosis (if applicable) or with the universal test adapter (if provided). Only then continue with the trouble-shooting chart.

If the customer complaint is not clear, check all the causes listed in the trouble-shooting chart. To prevent possible incorrect measurements, check all causes in the order given (owing to the interlinking of test steps).

If, after checking all the possible causes, the customer complaint has still not yet been rectified, then TRY installing a new specified coil or trigger box/control unit.

## HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (continued)

The TROUBLE-SHOOTING PROGRAM contains all system and component checks mentioned in the trouble-shooting chart. It is divided into three rows of boxes.

The left-hand column contains test instructions and set values.  
The center column contains instructions on trouble-shooting and fault rectification.  
The right-hand column contains the illustrations/terminal diagrams belonging to the text, with explanations.

If the questions in the left-hand column can be answered conclusively with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there.  
After rectifying a fault repeat the test as a check.

B01

==>

B02

<==

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

- Starting motor operates, but engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Rough idling (engine speed, exhaust gas).
- Poor throttle response, flat spot during acceleration.
- Engine misfiring (ignition, fuel injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine pinging/knocking.
- Engine overheating.
- Fault lamp.

Cause (component fault)										
*										Voltage at control unit
*			*							Magnetic pulse generator
*	*			*	*					Fuel pressure
			*	*						Fuel delivery
*	*			*	*					Solenoid-operated injection valves
	*			*						Throttle valve
	*	*		*						Throttle-valve switch
	*									Overrun cut-off
*	*	*								Idle actuator
	*									Idle speed, CO
*	*	*	*							Air-intake system
*	*	*	*	*	*	*				Air-flow sensor
					*	*				Temperature sensor (air)
*	*	*	*	*	*	*				Temperature sensor (engine)
*		*		*	*					Ignition coil
*		*	*	*	*					Primary signal
		*	*	*	*	*				Secondary pattern
*	*	*	*		*	*	*	*	*	Spark-advance angle
		*	*	*						Interference-suppression resistors
				*	*					Interference
	*	*	*				*			Tank vent
		*	*							Lambda closed-loop control
*	*	*	*	*	*	*		*	*	Control unit

For production reasons:  
continued on the following  
coordinate.

# TROUBLE-SHOOTING PROGRAM ( 1 )

V

Check power supply to  
Digifant control unit.

N>

Switch off ignition.

Disconnect control-unit plug  
(top picture - arrow).

Connect voltmeter to  
disconnected control-unit  
plug term 14 (+) and  
term 13 (-) or 19 (-)  
(center picture).

Switch on ignition.

Voltmeter must indicate

SET VALUE:  
Battery voltage

Set value obtained?

Y

Return to trouble-shooting chart  
B03

Switch off ignition.

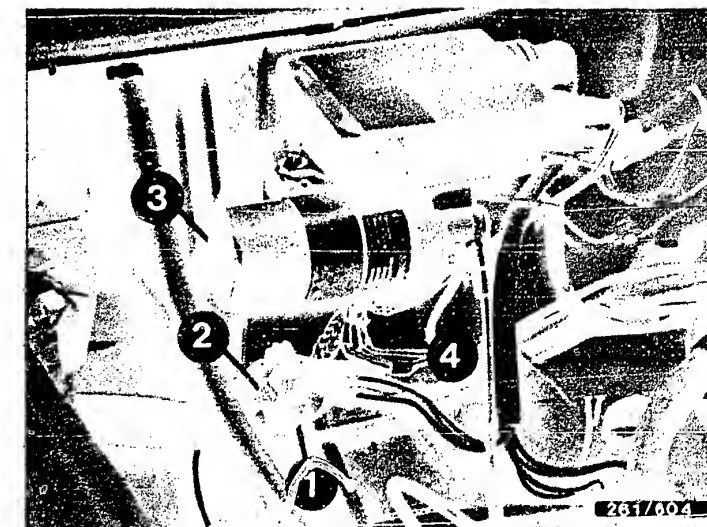
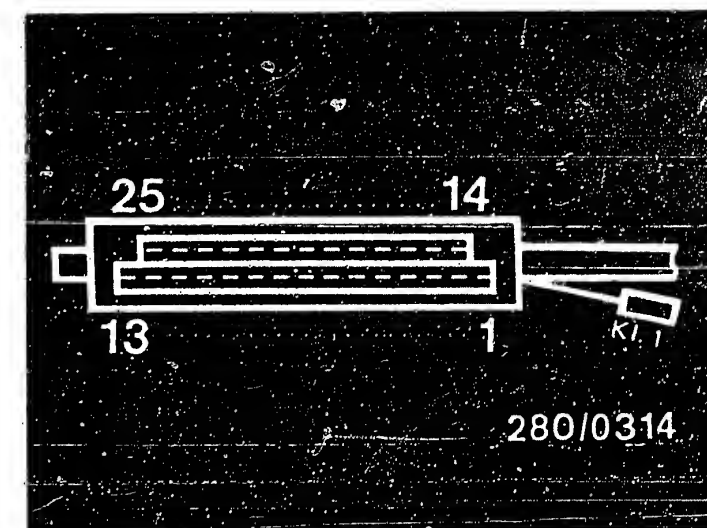
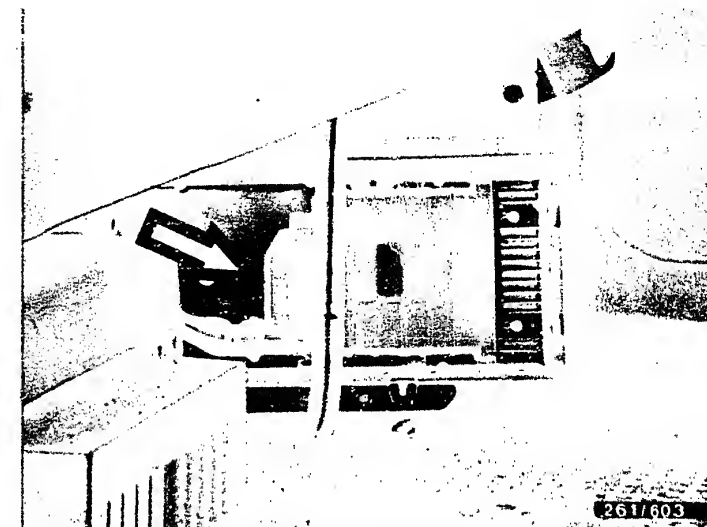
1. Connect ohmmeter to dis-  
connected control-unit  
plug term.13 or 19 and  
vehicle ground.

Ohmmeter must indicate approx.  
0  $\Omega$  (continuity).

Eliminate open circuit or  
contact resistance at  
ground terminals under  
ignition coil (bottom  
picture - Item 4) and on  
left-hand cylinder head  
at top.

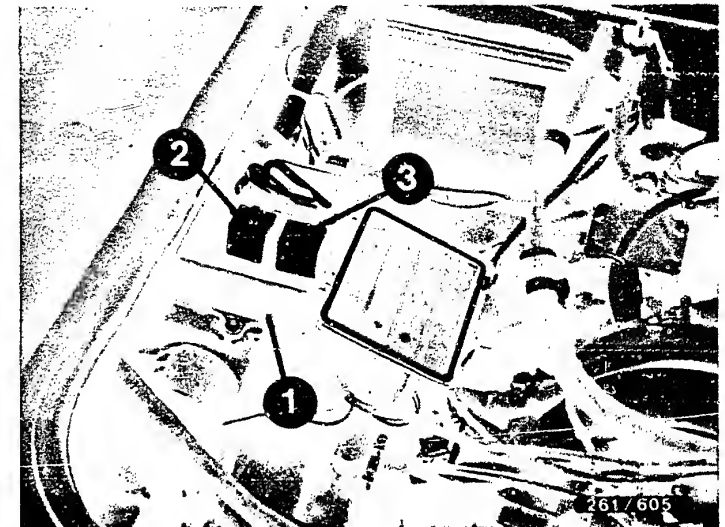
V

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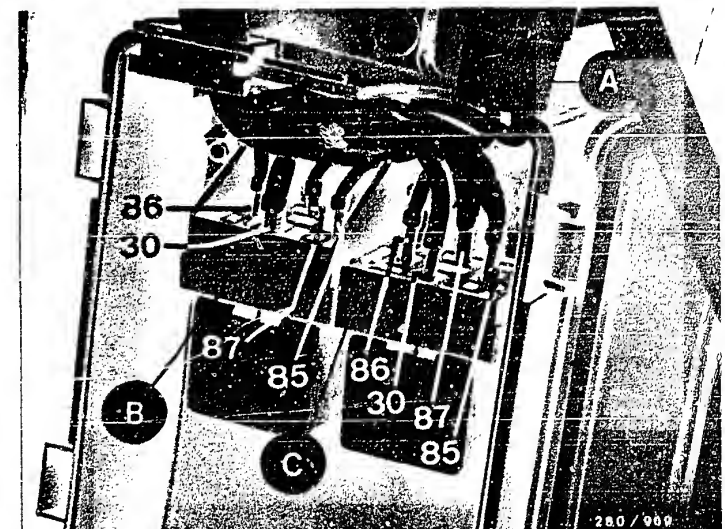


2. Main relay defective (top picture).  
Check the following lead for continuity:  
From control unit term.14  
to main relay term.87.
3. Measure voltages at  
main relay:
  - 3.1 Disconnect main relay and  
connect voltmeter to base  
term.86 (+) and  
term.85 (-).  
Switch on ignition.  
Voltmeter must indicate  
battery voltage.  
If not, check leads from  
ignition lock term.15 to  
relay term.86 and from  
relay term.85 to ground  
terminal for continuity  
(under the ignition  
coil).
  - 3.2 Connect voltmeter to  
relay base term.30 (+)  
and term.85 (-).  
Battery voltage must be  
measured. If not, check  
the lead to positive  
pole of battery.
  - 3.3 Connect voltmeter to  
relay base term.87 (+)  
and term.85 (-).  
Switch on ignition.  
Battery voltage must be  
measured. If not, relay  
defective.



- 1 = Relay box  
2 = Main relay  
3 = Pump relay

- A = Connector  
B = Main relay  
C = Pump relay



# TROUBLE-SHOOTING PROGRAM ( 2 )

Check voltage and control lines of magnetic pulse generator

N>

Eliminate open circuit,

Disconnect ignition-distributor plug (top picture - arrow).  
Connect ohmmeter with test prods, one after the other to:

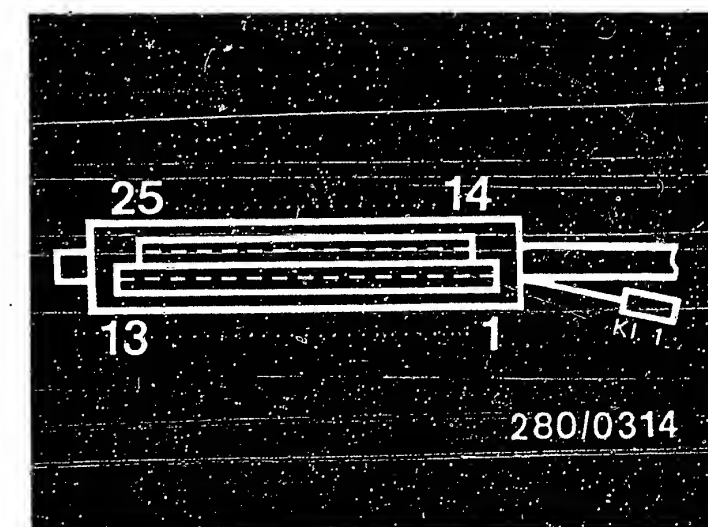
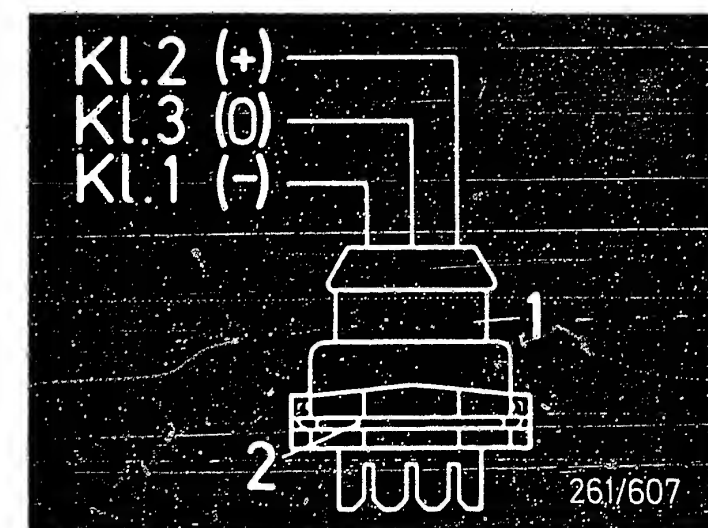
Ignition-dis- tributor plug	Control-unit plug
Term.1 (-)	and Term.6 (ground)
Term.2 (+)	and Term.8 (positive)
Term.3 (0)	and Term.18 (signal)

Term.1 (-) and Term.6 (ground)  
Term.2 (+) and Term.8 (positive)  
Term.3 (0) and Term.18 (signal)

(Center picture) (Bottom picture)

Ohmmeter must indicate continuity in each case.

O.K.?



Continued on next picture page



# TROUBLE-SHOOTING PROGRAM ( 2 ) CONTINUED ( 1 )

Check power supply to  
magnetic pulse generator

Control-unit and ignition  
distributor plugs (top  
picture - arrow) connected.

Push back rubber sleeve on  
ignition-distributor plug.

Connect voltmeter with  
test prods to the outer leads  
term 1 (-) and term 2 (+)  
(see bottom picture).

Switch on ignition.

The measured voltage must  
be at least 10 V.

Voltage O.K.?

N>

Disconnect ignition-distributor  
plug.

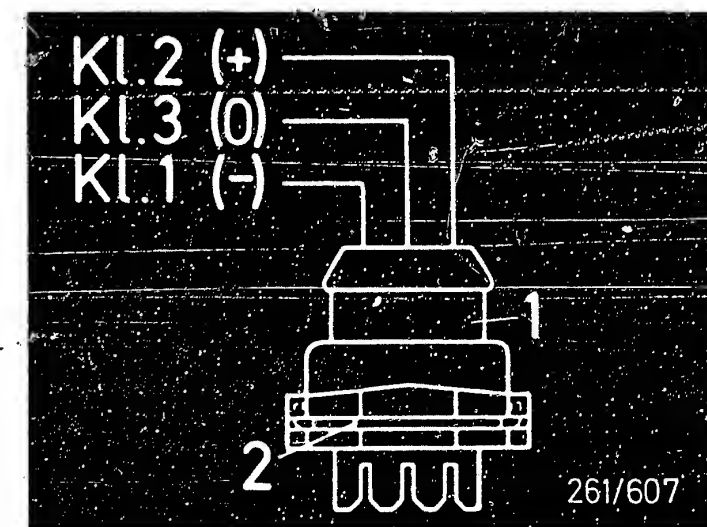
If battery voltage now  
indicated, replace magnetic  
pulse generator.

If voltage still too low  
(and power supply to control  
unit O.K.), replace control  
unit.



Arrow = Ignition-distributor connect

1 = Ignition-distributor plug  
2 = Wire retainer



Continued on next picture page

# TRUBLE-SHOOTING PROGRAM ( 2 ) CONTINUED ( 2 )

Check operation of magnetic pulse generator

N>

Replace magnetic pulse generator or ignition distributor.

Control-unit and ignition-distributor plugs connected (top picture).

Push back rubber sleeve on ignition-distributor plug.

Connect oscilloscope according to operating instructions with program switch in "special" position.

For example MOT 201:

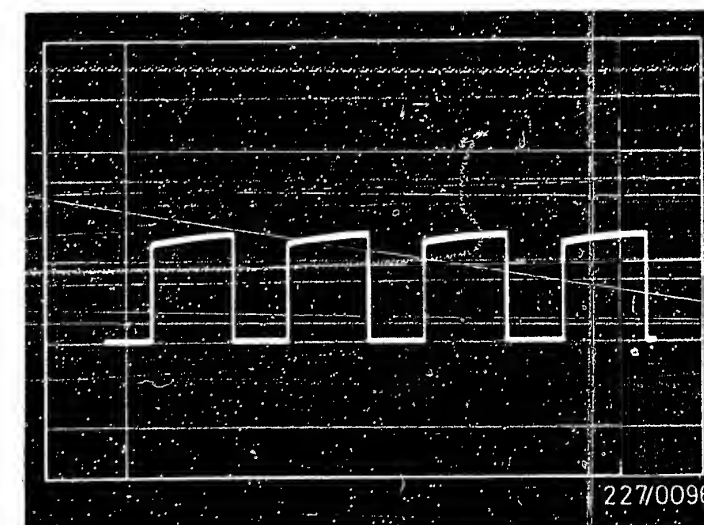
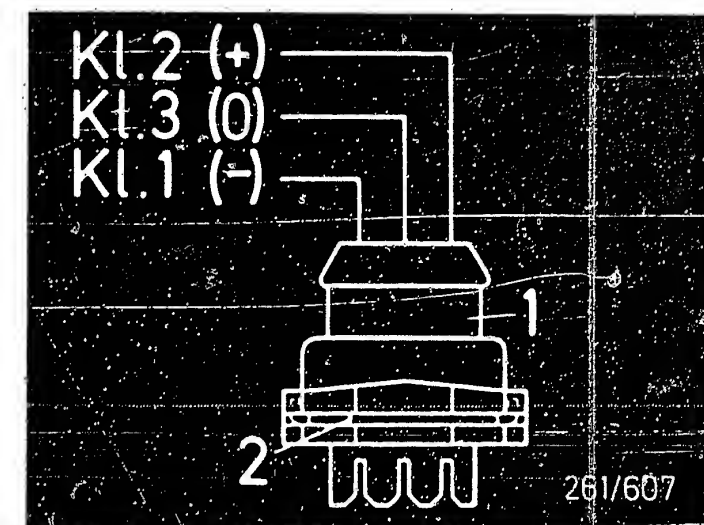
Red clamp with test prod to center terminal of ignition-distributor plug (green lead; term.3 (0). See center picture.

Black clamp to ground.

Start engine.

The oscilloscope must indicate a rectangular pulse (see bottom picture).

Rectangular pulse present?



Return to trouble-shooting chart B03

# TROUBLE-SHOOTING PROGRAM ( 3 )

Check fuel pressure with engine stopped.

Measure pressure upstream of pressure regulator. Measuring point in delivery line to fuel-distribution pipe or at fuel-pressure damper (if applicable). Loosen hexagon screw in Y-piece (top picture - arrow).

## CAUTION !

Catch escaping fuel.

Risk of fire if engine hot and electric sparks. Connect hose from pressure gauge 1 687 231 154 (center and bottom pictures - Item 1).

Make sure there are no leaks. Disconnect pump relay. Connect jumper between term.87 and term.30 in connection base. The electric fuel pump must operate.

Fuel pressure

SET VALUE: see brief instructions

Set value obtained?

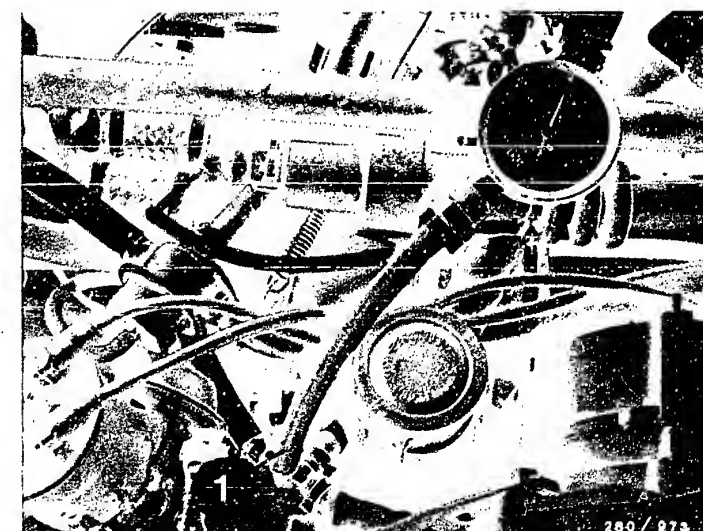
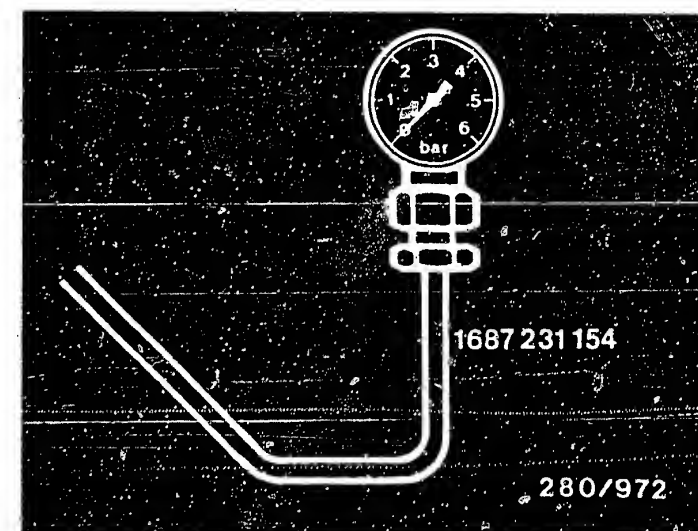
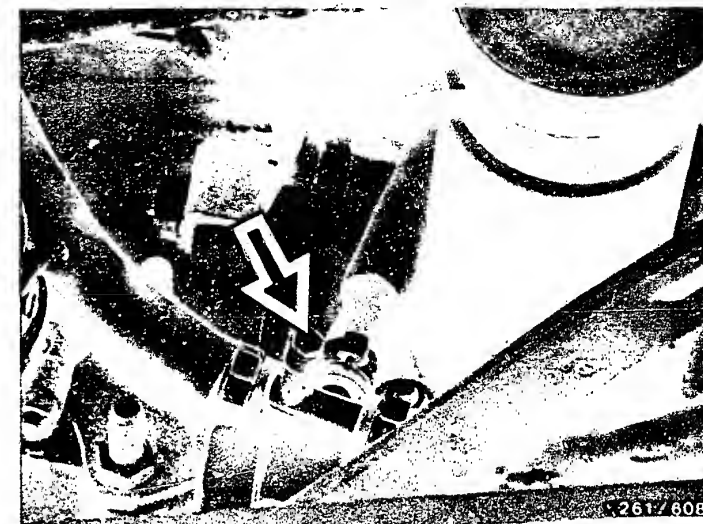
N>

\* Replace pump relay.

\* Measure voltage at disconnected pump connections.

If no voltage:  
Check positive lead from fuel pump to pump relay term.87 as well as pump ground lead.

If voltage present:  
Check pressure regulator and fuel pump (see next coordinate).



Continued on next picture page

Continued on next picture page

Set value not reached:

\*Slowly pinch off fuel return line.

Caution: pressure must not rise above 6 bar.

If pressure rises above 5 bar  
→ replace pressure regulator.  
In case of O ring sealing, use new O rings. Lightly grease with silicone grease (Ft 2 v 1).  
Pressure does not rise sufficiently: fuel pump defective.

\*Fuel filter very dirty  
→ replace.

\*Fuel delivery line or pressure damper (if applicable) clogged  
→ replace.

\*Strainer in tank clogged.  
Corrosion in tank.

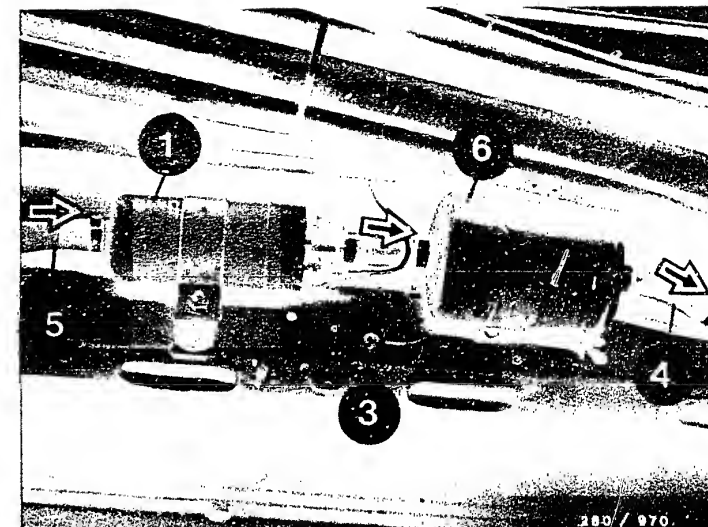
Set value exceeded:

Loosen fuel return hose from pressure regulator. Mount test hose on pressure regulator and lead into a 1.5l measuring glass.

Is set value now obtained?

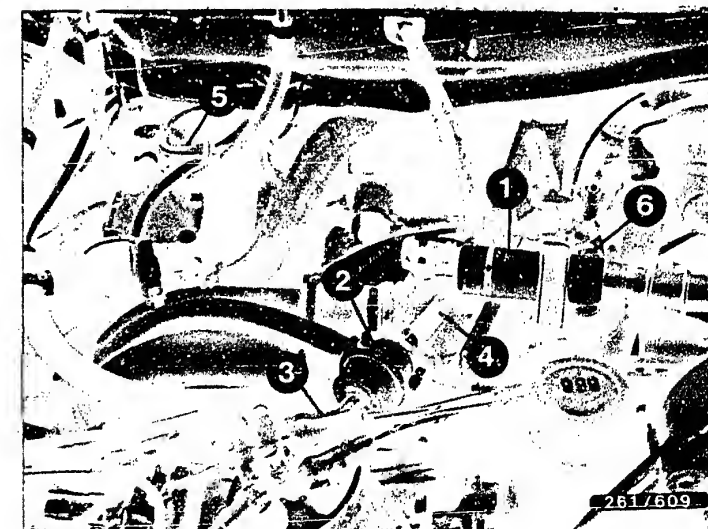
\*If yes, fuel return line clogged or pinched → replace.

\*If not, pressure regulator defective → replace.



- 1 = Electric fuel pump
- 3 = Ground connection of electric fuel pump
- 4 = Fuel delivery line
- 5 = Fuel intake line
- 6 = Fuel filter
- Arrow = Direction of fuel flow

- 1 = Idle actuator
- 2 = Pressure regulator
- 3 = Intake-manifold pressure line
- 4 = Fuel return line



Continued on next picture page

↓  
Check fuel delivery

Measure fuel delivery of electric fuel pump against pressure.

Measure, therefore, at the return downstream of the pressure reg.

Loosen fuel-return hose from pressure regulator.

Mount test hose on pressure regulator and lead into a 1.5-litre measuring glass (see top sketch).

Disconnect pump relay.

Connect jumper between term.87 and term.30 in connection base.

The electric fuel pump must operate.

Measuring time: 30 sec.

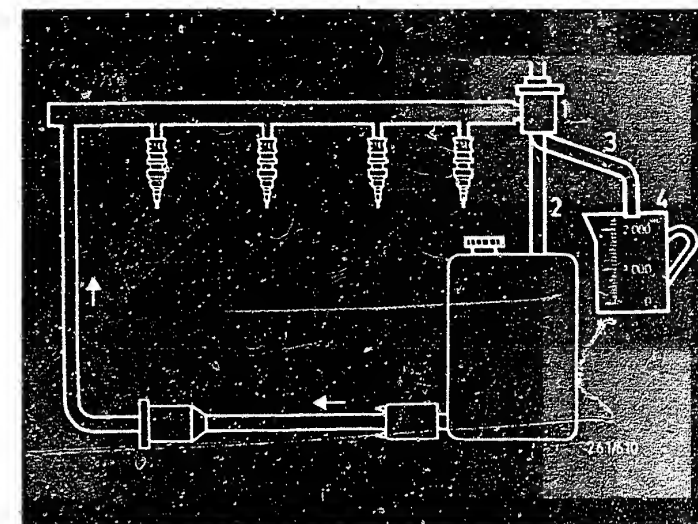
Fuel delivery

SET VALUE: see brief instructions

Set value obtained?

N>

- \* Fuel filter very dirty  
→ replace.
- \* Fuel delivery line  
clogged → replace.
- \* Voltage at electric fuel pump, with engine running, min. 12 V. If not, clean contacts, eliminate poor ground connection, replace leads.
- \* Check pre-supply pump (if applicable). Measuring point: line between the pumps.  
Fuel delivery must be at least 10% greater than that of the electric fuel pump. If not → replace pre-supply pump.
- \* If fuel-pump delivery too low → replace electric fuel pump. Clean connecting points before loosening so that no dirt gets into the fuel system. In-tank electric fuel pumps are accessible via a closure on the tank.
- \* If electric fuel pump noisy (vapor locks), intake line constricted or kinked → replace. Strainer in tank blocked → replace. Corrosion in tank → clean or replace.



————— Pressureless

||||||| Fuel pressure

1 = Pressure regulator

2 = Return

3 = Test hose

4 = Measuring glass

1 = Idle actuator

2 = Pressure regulator

3 = Intake-manifold pressure line

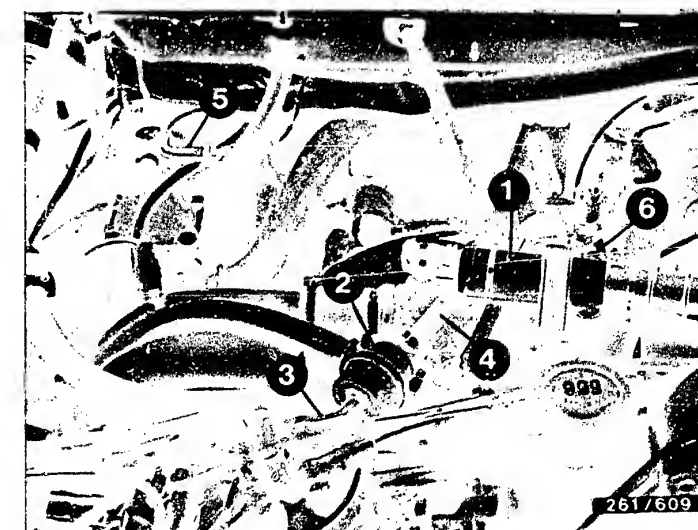
4 = Fuel return line

↓  
After testing:

Remove jumper and connect pump relay in connection base.

Remove test hose and mount fuel-return hose on pressure regulator. Make sure there are no leaks.

↓  
Return to trouble-shooting chart B03





# TROUBLE-SHOOTING PROGRAM ( 4 )

V

Check solenoid-operated injection valves with engine running.

N>

With engine running, disconnect injection-valve connectors, individually one after the other, from the injection valves and re-connect.

Engine speed must noticeably drop if injection valve is O.K.

Set value: drop in engine speed

Set value obtained?

Y

V

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No drop in engine speed ->

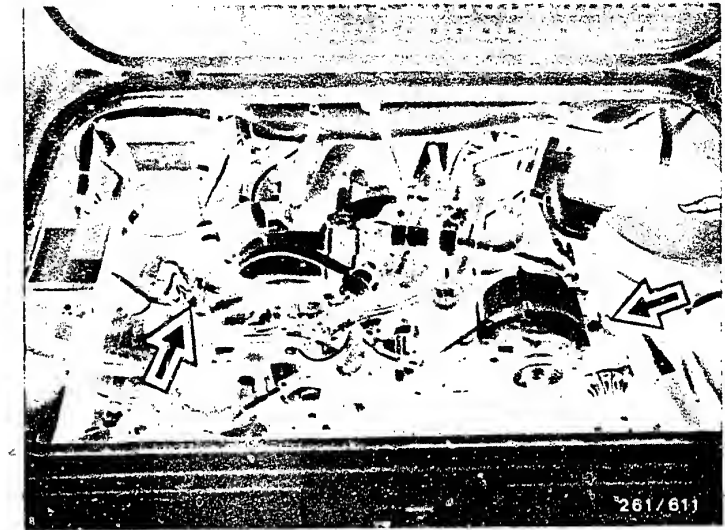
\* Check solenoid-operated injection valve with ohmmeter.

Set value: 15...17.5  $\Omega$

If necessary, replace defective injection valve.

\* Check positive leads from injection valves to main relay term.87 for continuity as well as negative leads to control unit term.12.

\* Replace solenoid-operated injection valve (mechanical defect).



Arrows = Solenoid-operated injection valves

V

Measure signal at solenoid-operated injection valve.  
Check for correct operation and interference.

N&gt;

Connect the two-pole test lead 1 684 463 093 between an injection valve and its connector.  
Connector motortester (special input) to test lead.  
Black clamp to vehicle ground.  
Connect red clamp to one of the two connections of the test lead.

**C a u t i o n :**  
The free connection of the test lead must not come into contact with ground.

Start engine or let engine run.  
If correctly connected, injection pulses will be visible on the oscilloscope (see diagram opposite).

Set value: diagram opposite

Set value obtained?

Y

V

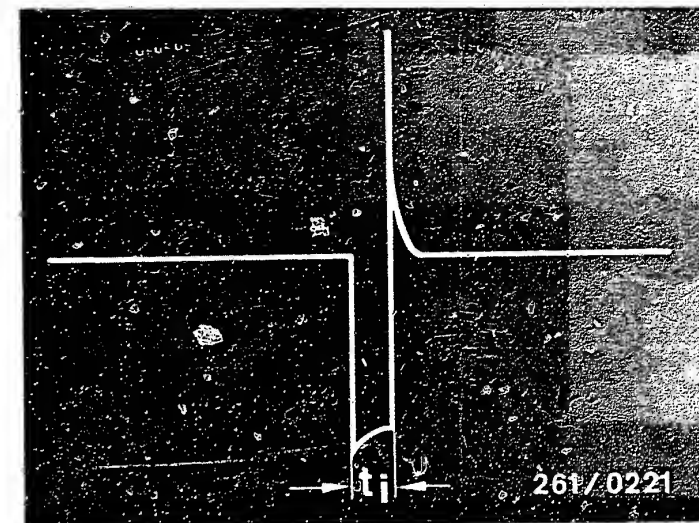
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No injection signal visible:

Check positive leads from injection valves to main relay term.87 for continuity.  
Do the same with the negative leads to the ctrl. unit term.12.  
If leads O.K., control unit defective.

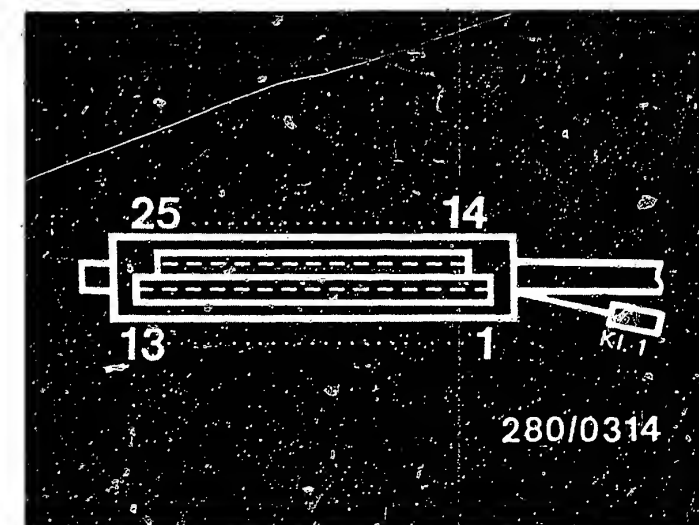
In case of interference, check the routing of the leads, i.e. ensure distance between ignition cables and wiring harness.  
Also, check the alternator (e. g. worn carbon brushes) and regulator.

In case of missing, check all injection-valve connectors and all other connections:  
spring contacts in the connector must be latched in and must not allow themselves to be pushed back.  
Contact surfaces must be bare down to the metal.  
Move connections with engine running and watch for missing.



Injection signal  
 $t_i$  = Duration of injection

Top view of control-unit plug



# TROUBLE-SHOOTING PROGRAM ( 4 ) CONTINUED ( 2 )

Check fuel pressure with engine running.

Let engine idle.

Fuel pressure  
SET VALUE: approx. 0.5 bar  
lower than with engine stopped.

Set value obtained?

N>

\*Intake-manifold-pressure energization of pressure regulator not O.K. Hose line between pressure regulator and intake manifold clogged or leaking → replace.  
Hose line dropped off → re-connect.

\*If intake-manifold-pressure energization O.K. → replace pressure regulator.

Check fuel pressure after switching off engine (checking for leaks).

Fuel pressure  
SET VALUE: min. 1.0 bar  
after 20 minutes.

Set value obtained?

N>

\* Joints between components, fuel hoses and fuel lines leaking → tighten hose clamp or replace hose.

\* Pressure regulator (diaphragm) leaking → replace.

\* Electric fuel pump (non-return valve) leaking.  
If non-return valve of screw type → replace.  
If non-return valve of integral type → replace electric fuel pump.

\* Fuel filter leaking → replace.

After testing:

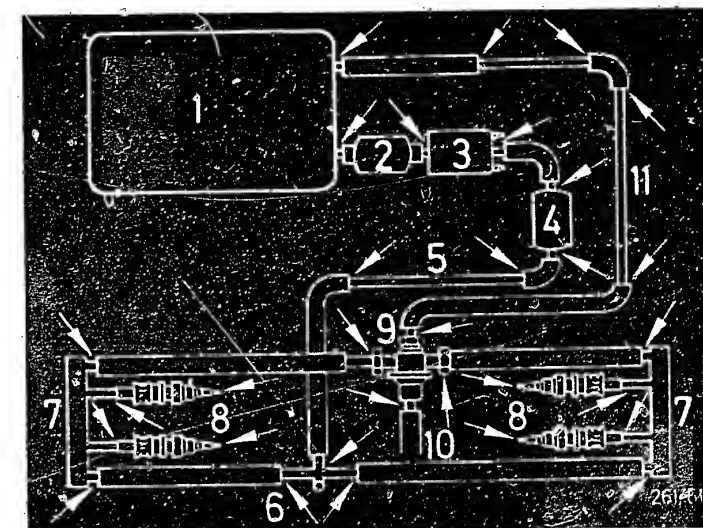
Remove jumper and connect main relay into connection base.

Remove pressure tester.  
Connect fuel-inlet hose to fuel-distribution pipe.

Make sure there are no leaks.

Return to trouble-shooting chart B03

Continued on next picture page



- 1 = Fuel tank
- 2 = Fuel-intake filter (if applicable)
- 3 = Fuel pump
- 4 = Fuel filter
- 5 = Fuel delivery line
- 6 = Connection for pressure tester
- 7 = Fuel-distribution pipe
- 8 = Injection valves
- 9 = Pressure regulator
- 10 = To intake manifold
- 11 = Fuel return line

Arrows = possible leaks

V

If set value not obtained:

\* Injection valve(s) leaking at connecting point to fuel-distribution pipe → retighten hose clamp or replace hose piece(s) (bottom picture).

\* Check injection(s) (needle seat) for leaks:  
Remove complete fuel-distribution pipe.  
Inlet and return remain connected.  
Withdraw both injection valves simultaneously out of their guides in the intake manifold.  
Previously remove fastening screws (bottom picture).  
Connect jumper between term.87 and term.30 in connection base (pump relay) (top picture).  
Electric fuel pump must operate.

#### SET VALUE:

Within 60 sec. no drop may fall from the injection valve.

If incorrect → replace injection valve.

R e m o v a l :

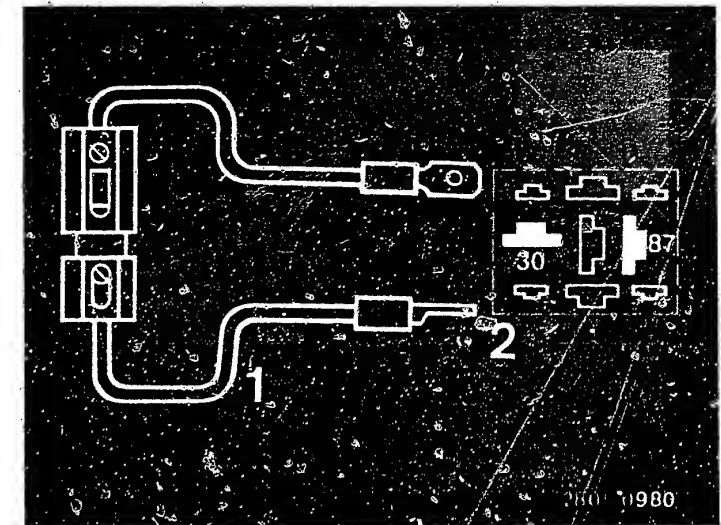
Disconnect connector.

C a u t i o n !

Catch escaping fuel; it must not get on to hot parts of the engine.

V

Continued on next picture page



1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base

1 = Injection valve

2 = Connector

3 = Fuel distribution pipe

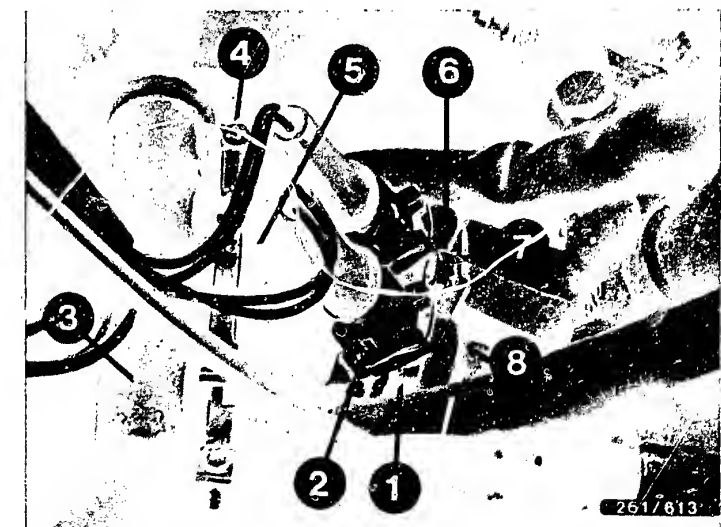
4 = Hose clamp

5 = Connecting hose to valve

6 = Holding plate

7 = Fastening screw

8 = Rubber ring



If injection valve (needle seat) is not leaking, but connecting hose is defective replace hose.

Use parts set 1 287 010 701.

**Warning !**  
Do not damage protective sleeve or valve needle.

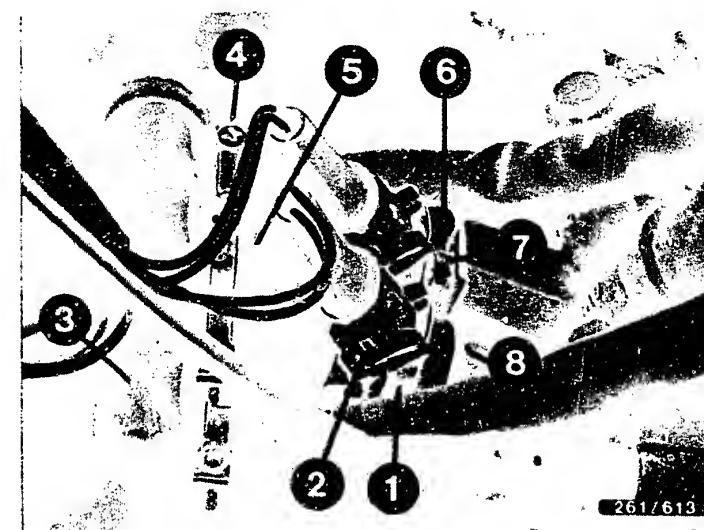
If lower O-ring (intake manifold) defective, cut it open.  
Slip new O-ring over the protective sleeve and its bead.

**Installation :**  
Grease O-rings only lightly (silicone Ft 2 v 1).  
Connect hose piece with valve on to fuel-distribution pipe and tighten hose clamp.

Check for leaks.  
Connect connector.

Install complete fuel-distribution pipe.  
When doing this, press both injection valves simultaneously into their guides in the intake manifold.

**Caution !**  
Do not damage O-rings or valve needles. Make sure there are no leaks at intake manifold.



- 1 = Injection valve
- 2 = Connector
- 3 = Fuel distribution pipe
- 4 = Hose clamp
- 5 = Connecting hose to valve
- 6 = Holding plate
- 7 = Fastening screw
- 8 = Rubber ring

Return to trouble-shooting chart  
B03



# TROUBLE-SHOOTING PROGRAM ( 5 )

Increased noise from electric fuel pump.

In case of:

- high outside temperatures,
  - high fuel temperatures,
  - fuel tank almost empty,
  - lengthy full-load driving or
  - at idle,
  - use of winter fuel at warmish outside temperatures,
- vapor locks in the intake line may lead to noises at the electric fuel pump.

Are pump noises normal?

N>

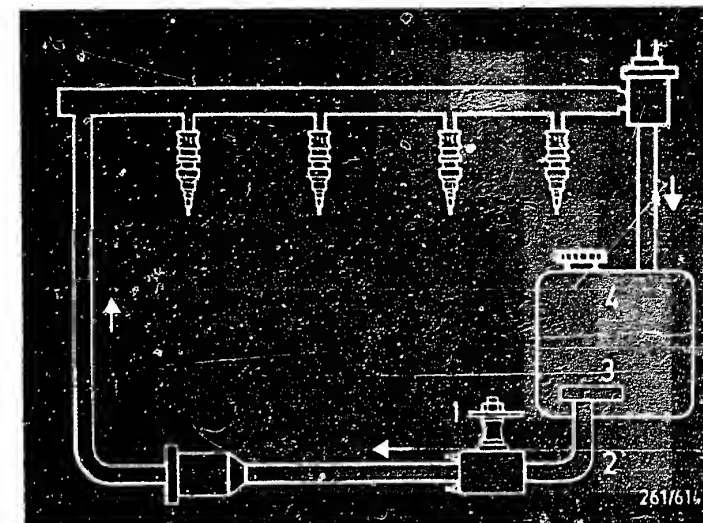
\* Pump mounting (vibration damper) defective -> replace (see sketch).

\* Intake line restricted or kinked -> replace.

Strainer in fuel tank clogged -> replace.

\* Intake line or delivery line transmitting pump noises to vehicle body -> lay lines free of tension, replacing if necessary.

\* If fuel tank almost empty -> fill.



- 1 = Pump mounting
- 2 = Intake line
- 3 = Intake strainer
- 4 = Fuel level

Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM ( 6 )

V

Mechanical test of air-flow sensor:

N>

Replace air-flow sensor.

Remove air-flow sensor.

Open sensor flap by hand.

It must be possible to open the sensor flap with uniform ease as far as its fully open position. When released, the flap must close again completely by itself.

Sensor flap must not catch when opening.

Watch for signs of rubbing.

Clean air-flow sensor if inside is very dirty and rub out with a lint-free cloth.

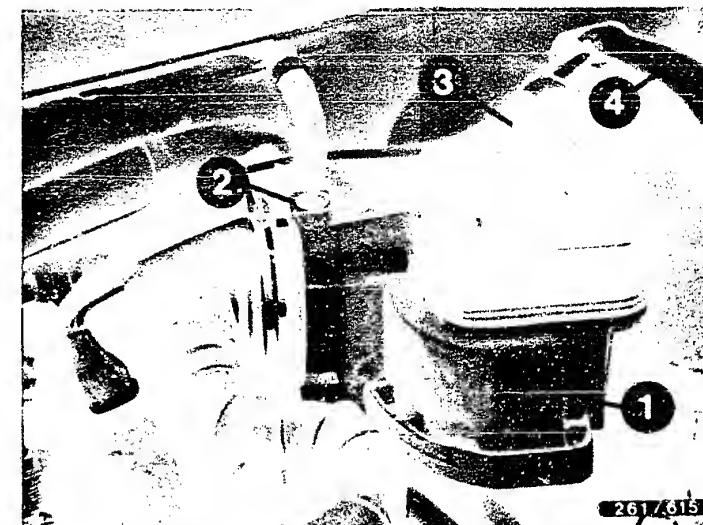
Is it possible to open sensor flap with uniform ease?

No signs of rubbing visible?

Y

V

Continued on next picture page



- 1 = Air-flow sensor
- 2 = CO adjusting screw
- 3 = Connector (rubber sleeve)

Electrical test of air-flow sensor:

Remove air-flow sensor.

Leave plug on.

Push back rubber sleeve on plug.

Switch on ignition.

Using test prods, measure voltage at back of plug (top picture).

Power supply term.3(+) and term.4(-):

SET VALUE: greater than 4.5 V

Wiper voltage (load)

term.2(+) and term.4(-):

SET VALUES:

air-flow sensor flap in neutral position

200...300 mV

Open air-flow sensor flap by hand to end.

Greater than 4.2 V

Test temperature sensor (air):

Switch off ignition.

Disconnect plug from air-flow sensor.

Resistance between pin 1 and pin 4 of air-flow sensor (bottom picture).

SET VALUES:

at ambient temperature

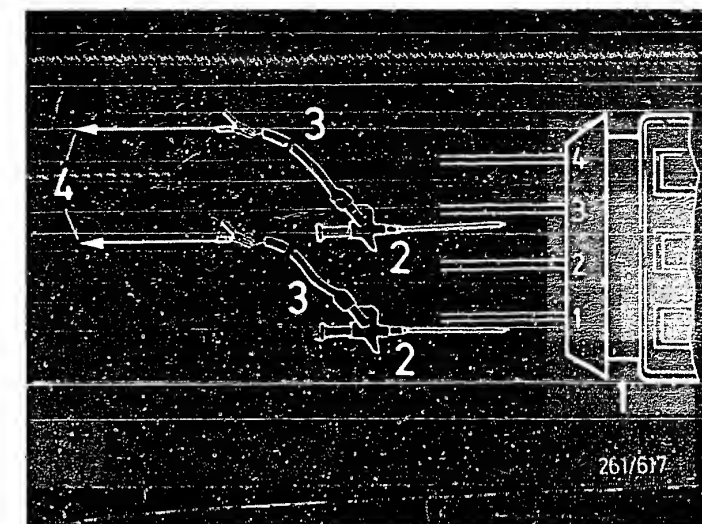
(+15...+30° C):

1.45...3.3 k  $\Omega$

Set values obtained?

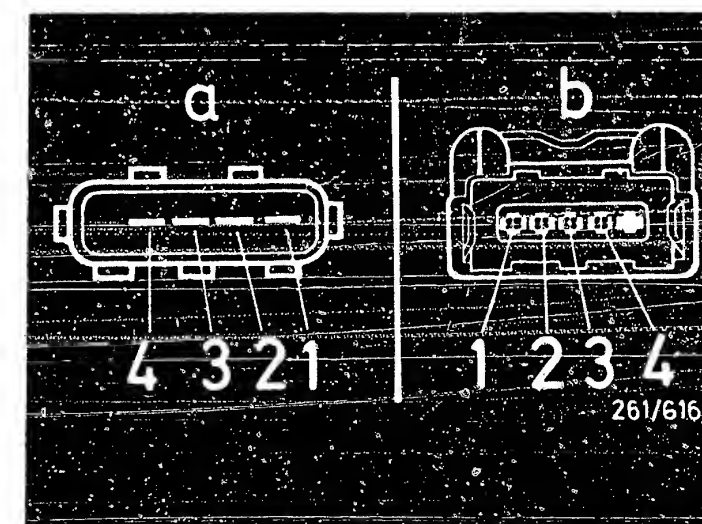
N>

Replace air-flow sensor.



- 1 = Air-flow sensor plug
- 2 = Test prod
- 3 = Adapter lead (user-fabricated)
- 4 = To voltmeter

- a = Electrical connection on air-flow sensor
- b = Electrical test



Continued on next picture page

Test potentiometer in air-flow sensor using oscilloscope (noise test)

\* Remove air-flow sensor.

Leave electrical connector connected.

Push back rubber sleeve.

Position motortester to special input.

Connect special cable at air-flow sensor to term.2 (red clip) and term.4 (black clip).

\* Fabricate adapter lead yourself:

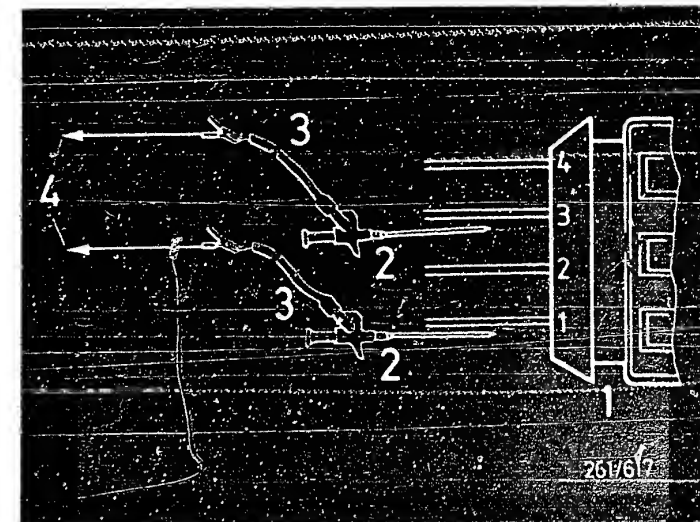
two leads approx. 1 m long, cross section approx. 1.0 mm<sup>2</sup>.

Attach 2 test prods on the one side. On the other side, strip approx. 2 cm plastic insulation from the lead and clamp on with the clamps of the special-input connecting lead.

A t t e n t i o n !

Insulate bare junctions of adapter leads (danger of short circuit). Measure carefully at connector of air-flow sensor.

Do not bend the spring contacts! Position control lever for framing on motortester to left-hand stop (calibrated adjustment).



- 1 = Air-flow sensor plug
- 2 = Test prod
- 3 = Adapter lead (user-fabricated)
- 4 = To voltmeter

Continued on next picture page

↓  
\* Switch on ignition.

\* Deflect air-flow sensor flap abruptly several times.

If air-flow sensor in proper working order, a stroke signal without breaks must be visible on the oscilloscope.

If the air-flow sensor is defective, a noise signal appears similar to that in the figure opposite.

Disconnect adapter lead after testing and push rubber sleeve on properly.

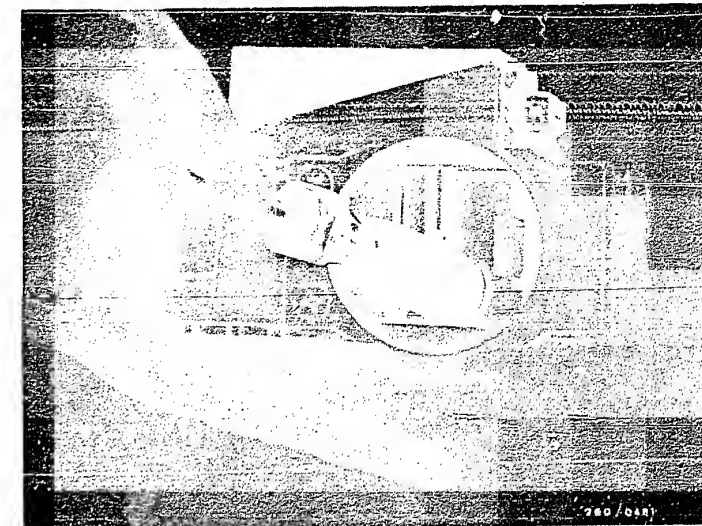
Mount air-flow sensor.

Push on all hoses and tighten (leak-tight).

Signal O.K.?

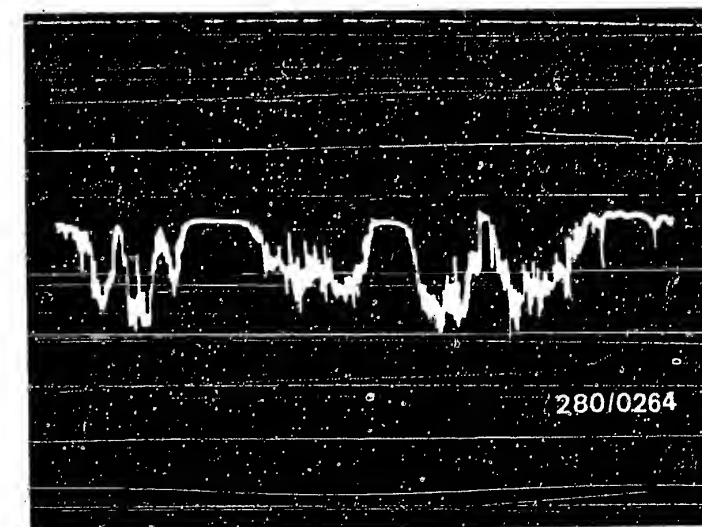
N>

Replace air-flow sensor.



Opening the air-flow sensor flap

Noise signal if air-flow sensor defective



↓  
Return to trouble-shooting chart B03



# TROUBLE-SHOOTING PROGRAM ( 7 )

Test throttle-valve switch  
(common contact for idle and  
full load).

Disconnect 2-pole plug to  
throttle-valve switch  
(upper illustration).

Connect ohmmeter to the  
two pins of the socket.

Throttle valve closed.  
SET VALUE: 0  $\Omega$  (continuity).

Open throttle valve:  
Reading must change to infinity  
 $\Omega$  after the throttle valve  
has been slightly opened.

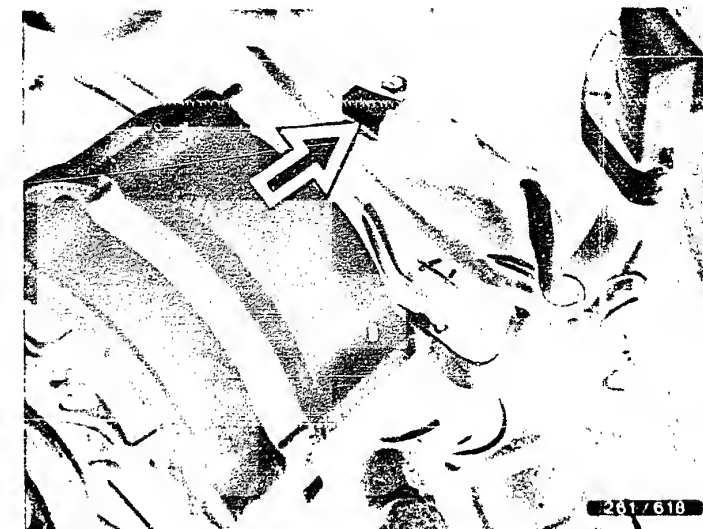
Apply full throttle.  
SET VALUE:  
Before the full-load stop,  
reading changes from infinity  
to 0  $\Omega$

Resistance values obtained?

N>

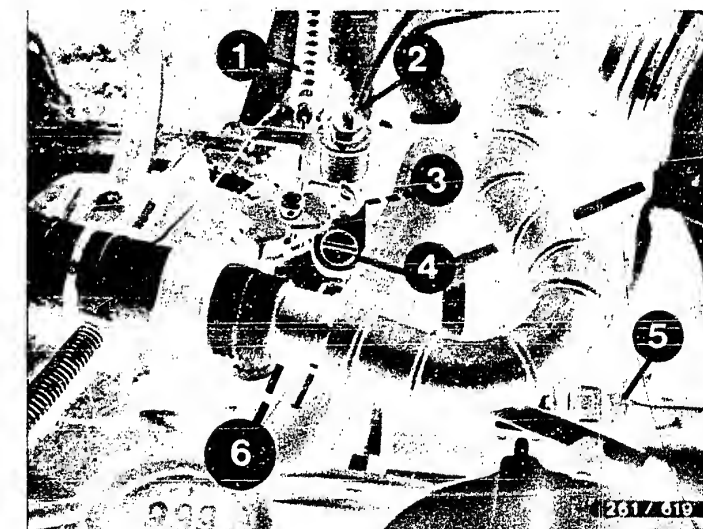
Idle contact not closing  
(reading remains constant  
infinity  $\Omega$ ) or  
idle contact opening too  
late:  
adjust throttle-valve  
switch.

Requirements for adjusting  
the throttle-valve switch:  
\* Throttle valve correctly  
adjusted? Just before it  
sticks, it must come up  
against the stop screw  
with the lever (bottom picture).  
\* Adjust throttle cable-  
linkage free of tension.  
If kinked  $\rightarrow$  replace.  
Adjusting the throttle-valve  
switch:  
Slightly loosen left-hand  
fastening screw (hexagon-  
socket-head). Take apart  
plug connector to throttle-  
valve switch and connect  
ohmmeter. Turn right-hand  
hexagon-socket-head cap  
screw (eccentric) until  
the idle contact closes  
(switch clicks audibly).  
Reading 0  $\Omega$ . If not  $\rightarrow$   
replace throttle-valve  
switch.  
Checking the adjustment:  
pull slightly on throttle  
cable. Idle contact must  
open (switch clicks audibly).  
Reading: infinity  $\Omega$



Arrow = Throttle-valve  
switch connection

- 1 = Throttle cable
- 2 = Throttle-valve shaft
- 3 = Throttle-valve stop  
screw
- 4 = Idle-adjusting screw
- 5 = Connection to throttle-  
valve switch
- 6 = Throttle-valve switch  
(not visible in picture)



Continued on next picture page

Continued on next picture page

Check the following leads for open circuit with ohmmeter:

- \* From Digifant control unit term.11 to throttle-valve switch connection.
- \* From throttle-valve switch connection to spring contact No.8 of control unit for idle-speed control (bottom picture).

The second terminal in the plug must have contact to ground.

SET VALUES: 0  $\Omega$

Check plug for corrosion and loose contact. Contacts must not allow themselves to be pushed back.

Set values obtained?

Contacts O.K.?

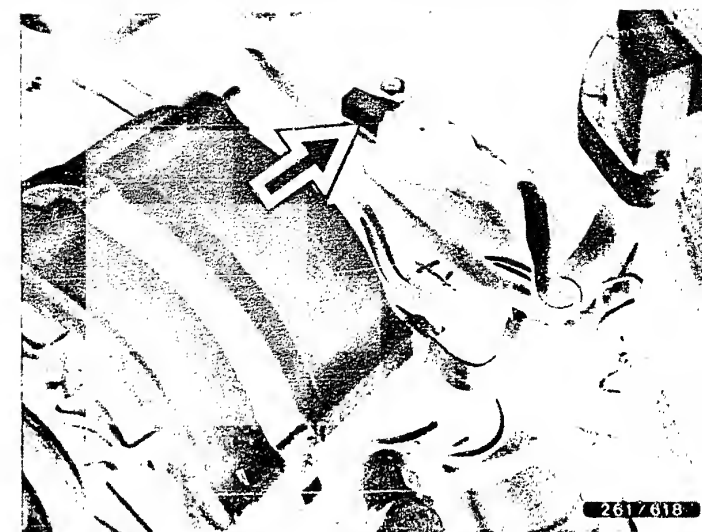
Return to trouble-shooting chart B03

- \* "Full-load contact" not operating  
(Despite wide-open throttle, reading remains at inf.  $\Omega$ ):

Check whether throttle valve is mechanically able to open fully. If O.K., remove throttle-valve switch and check mechanicals.

Note :  
The full-load range cannot be adjusted.  
If the idle contact is correctly adjusted, the switching point of the full-load range will also be corrected.

Repair defective leads/  
plug.



Arrow = Throttle-valve switch connection

Arrow = Control unit for idle-speed control



## TROUBLE-SHOOTING PROGRAM ( 8 )

V

### Adjusting the throttle valve

#### Note :

The throttle-valve stop screw is set at the factory and must not be changed.

If, however, it has turned by mistake, or, despite correct adjustment (idle contact, CO, air-intake system leak-tight), the engine hunts, check the throttle valve.

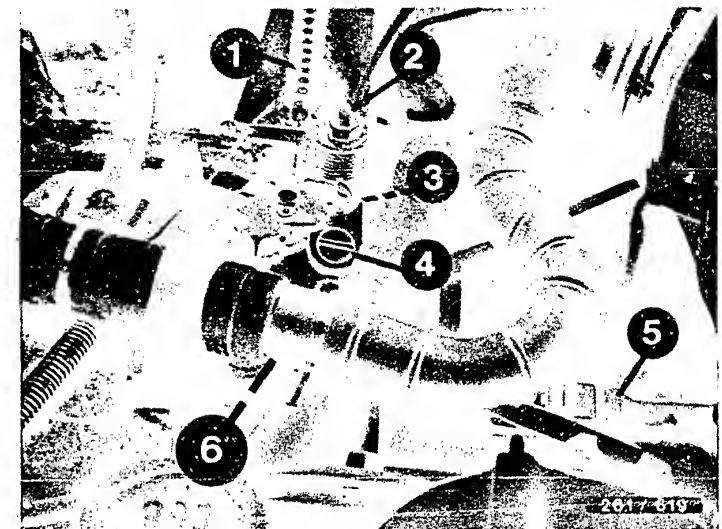
With the throttle cable free of tension, it must close properly, but must not stick in the throttle-valve assembly.

Adjustment correct?

N>

### Basic adjustment of throttle valve:

- \* Unscrew throttle-valve stop screw until there is a gap between screw and stop.
- \* Screw in screw until it touches the stop.
- \* Screw in a further 1/2 turn.
- \* Then check idle contact, idle speed and CO.
- \* At wide-open throttle, throttle valve must be fully open.



- 1 = Throttle cable
- 2 = Throttle-valve shaft
- 3 = Throttle-valve stop screw
- 4 = Idle-adjusting screw
- 5 = Connection to throttle-valve switch
- 6 = Throttle-valve switch (not visible in picture)

V

Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM ( 9 )

V

## Check air-intake system:

Check whether hoses of air-intake system are correctly connected, not kinked or damaged.

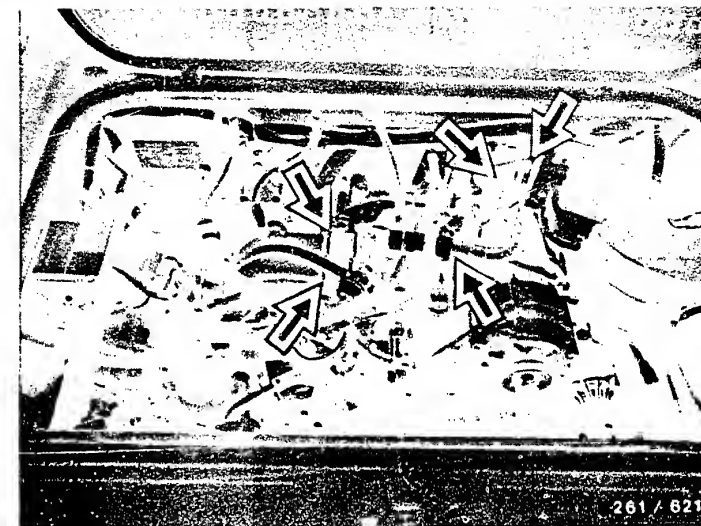
Check whether oil dipstick is inserted as far as it will go and whether the seal of the cap on the oil filter neck is O.K.

Are all hoses O.K.?

N>

Replace hoses if necessary.

Eliminate leaks by new seals or by re-tightening the hose clamps.



Arrows = Joints on air-intake system

Y

Continued on next picture page

C19

<==>

C20

<==>

Leak test on air-intake system:

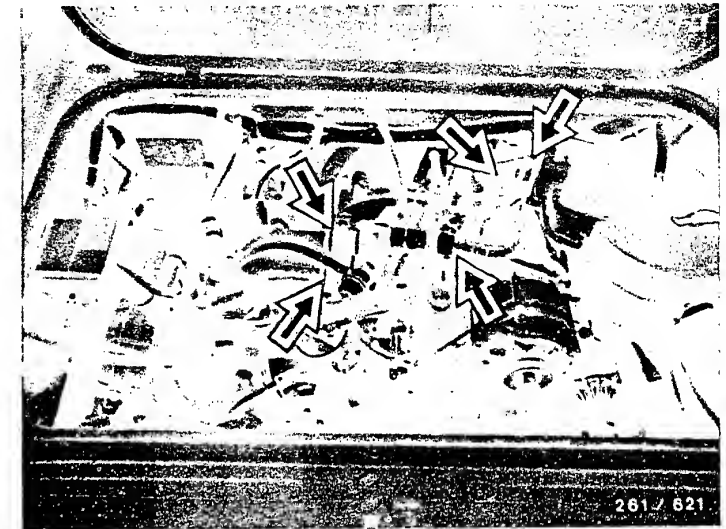
Seal off exhaust tail pipe.  
Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.  
Disconnect hose after idle actuator. Seal off idle actuator connector port.  
Open throttle valve fully.  
Using a compressed-air gun blow air (0.3 bar gauge pressure) into the intake manifold. Using leak-detector spray or soapy water, spray or brush all joints.  
Bubbling or foaming indicates a leak.

All joints leak-tight?

N>

Eliminate leaks by new seals or by re-tightening the hose clamps.

Leaks may also occur at the following points: oil dipstick not securely inserted, defective seal on cap of filler neck etc.



Arrows = Joints on air-intake system

Return to trouble-shooting chart B03

## TROUBLE-SHOOTING PROGRAM (10)

V

### Check ignition coil

N>

#### Visual examination:

Remove protective cap from ignition coil and check whether plug (top picture) is in position and whether any sealing compound has escaped.

#### Electrical check:

Measure resistance of ignition coil, primary, term.15 and term.1 (take resistance of test lead/test prods into account) and secondary (term.1 and term.4).

#### SET VALUES:

see brief instructions

Plug in position and/or no sealing compound escaped?

Resistance values O.K.?

Y

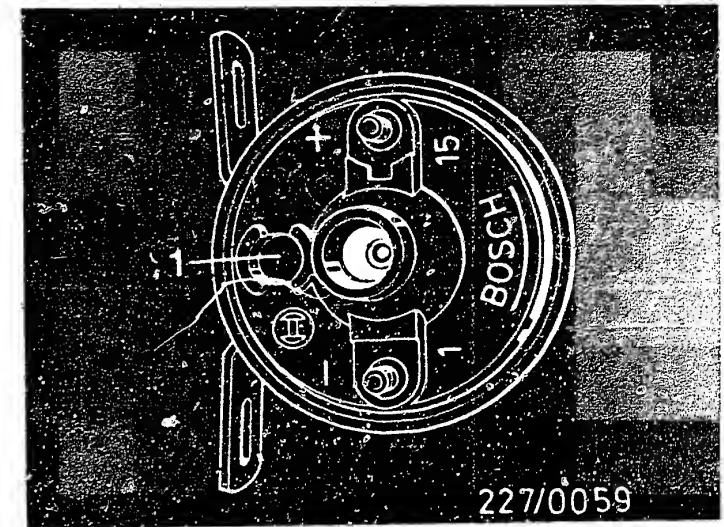
Return to trouble-shooting chart B03

1. If plug is not in position and/or sealing compound has escaped:

Replace ignition coil and control unit (ignition output stage defective).

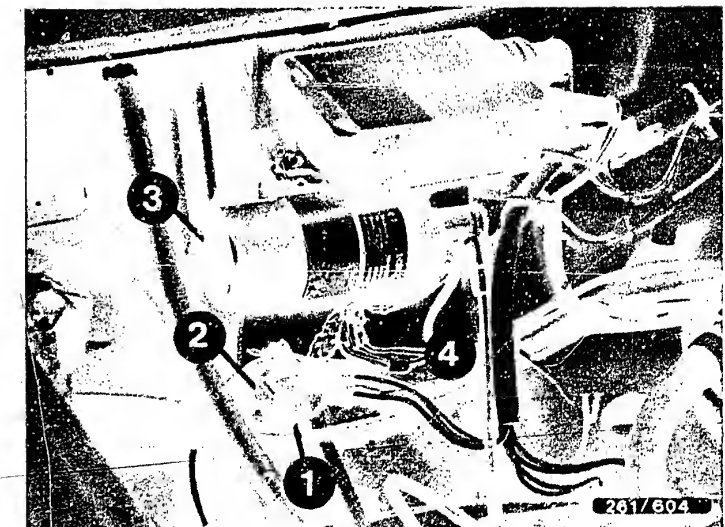
Check lead from ignition coil term.1 to control unit term.25 for continuity ( $0 \Omega$ ).

2. Replace ignition coil if resistance values not within tolerance.



1 = Plug

3 = Ignition coil  
4 = Ground point





# TROUBLE-SHOOTING PROGRAM (11)

## Check idle actuator.

- \* Disconnect plug (2-pole) and measure winding resistance directly at idle actuator.

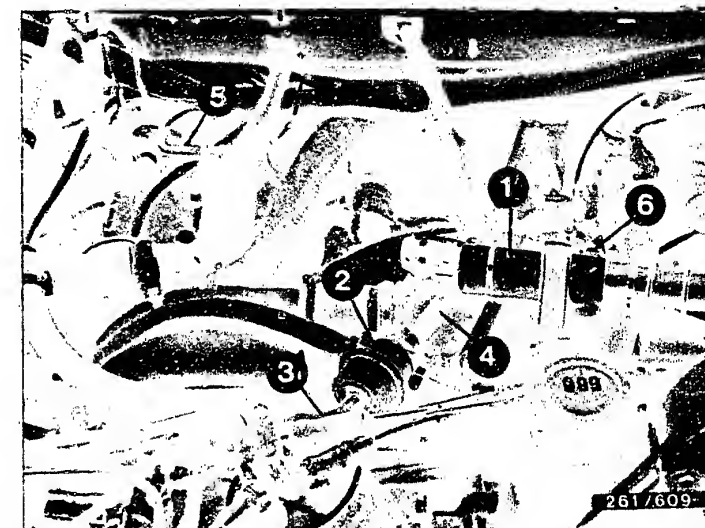
SET VALUE:  
see brief instructions

- \* Check leads from control unit for idle-speed control term.4 and term.11 to idle actuator for continuity.
- \* Check spring contacts for corrosion and loose contacts. Contacts must not allow themselves to be pushed back.
- \* Slide of idle actuator must not stick or catch.

Winding resistance, leads and slide O.K.?

N>

- \* Winding resistance not within tolerance:  
replace idle actuator.  
Pay attention to direction of flow.
- \* Repair leads and plug-in connections.
- \* Slide mechanically defective:  
replace idle actuator.  
Pay attention to direction of flow.



- 1 = Idle actuator
- 2 = Pressure regulator
- 3 = Intake-manifold pressure line
- 4 = Fuel return line

Arrow = Control unit for  
idle-speed control



Continued on next picture page

# TROUBLE-SHOOTING PROGRAM (11) CONTINUED ( 1)

Check energization of  
idle actuator.

Switch on ignition.

Idle actuator is pulsed  
by the control unit for  
idle-speed control and  
vibrates (detectable by hand).

Does idle actuator vibrate?

N>

Measure current to idle  
actuator at idle:

- Plug connector (top picture -  
Item 2) taken apart.
  - Plug connector connected.
- SET VALUES: see brief instruct.

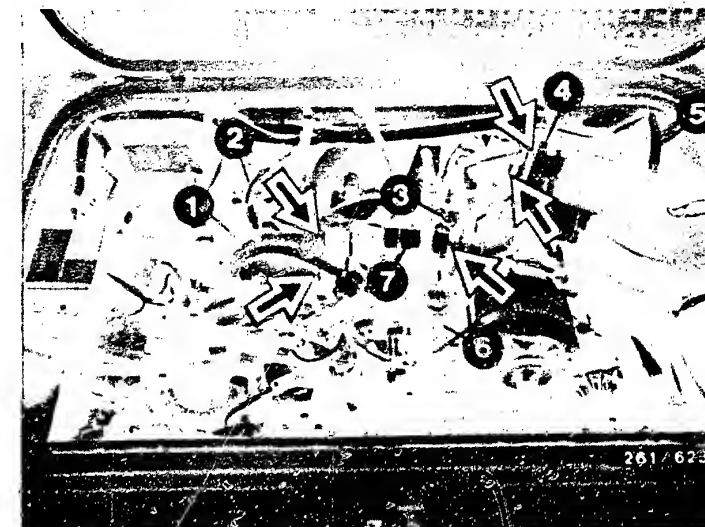
Note test conditions:

- Engine at operating temp.
- Electrical equipment  
off
- Air-intake system leak-tight
- Ignition O.K.
- Idle speed and CO  
correct
- Hose for crankcase  
ventilation disconnected from  
oil breather and sealed off

If set values not obtained,  
check power supply to  
control unit for idle-speed  
control (battery voltage at  
term.14/term.5-  
with ignition on; see circuit  
diagram).

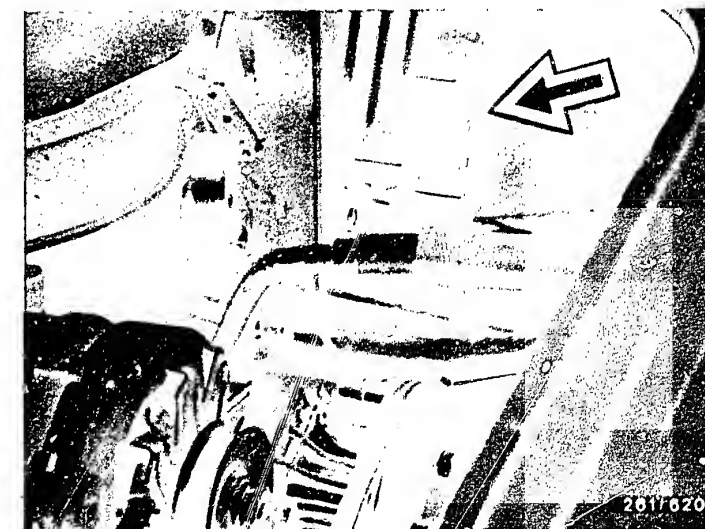
Before replacing the control  
unit for idle-speed control,  
check the following:

- Dwell-period signal present  
at term.17?
- Lead to temperature  
sensor (engine) (term.13)



- 1 = Temperature sensor (engine)
- 2 = Plug connector (single)
- 3 = Idle-speed  
adjusting screw
- 4 = Co adjusting screw
- 5 = Hose to active-carbon  
container
- 6 = Oil breather
- 7 = Idle actuator

Arrow = Control unit for  
idle-speed control



Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM (12)

V

Check primary signal with  
oscilloscope

N>

Connect oscilloscope to  
ignition coil term.1.

Digifant control unit  
connected.

Shift gear to neutral and  
start.

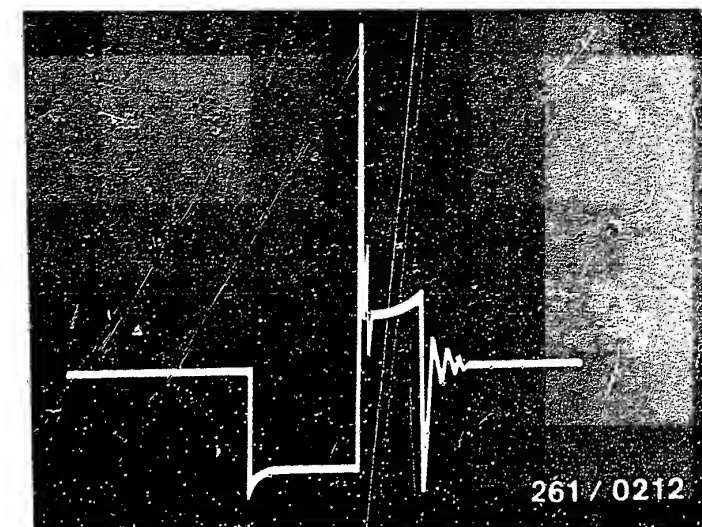
SET VALUE:  
Primary signal must be  
present (top picture).

Primary pattern present?

Primary signal not present:

- \* Check lead from ignition  
Coil term.1 to control unit  
term.25 for continuity.
- \* If lead O.K., replace  
control unit.

Condition:  
Power supply to control  
unit present and magnetic  
pulse generator O.K. and  
ignition coil checked.



Primary signal

V

Continued on next picture page

# TROUBLE-SHOOTING PROGRAM (12) CONTINUED ( 1)

Check secondary patterns of all cylinders and interference-suppression resistors.

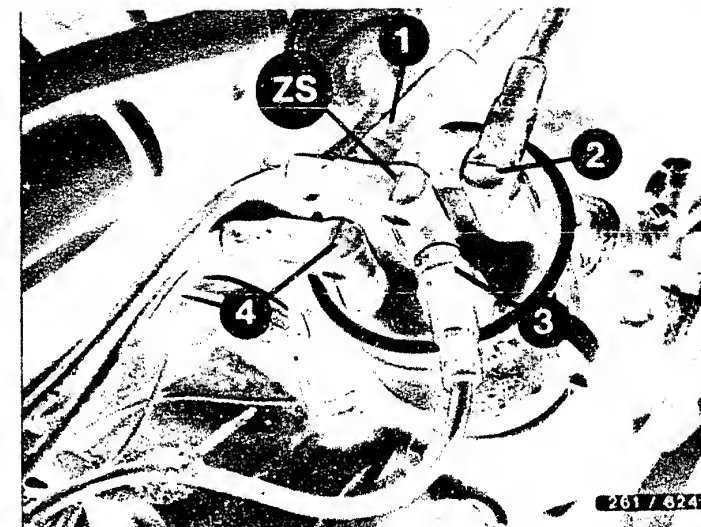
## SET VALUES

For interference-sup.resistors:  
See brief instructions

Secondary patterns and interference-sup.resistors O.K.?

N>

- \* Distributor cap oil-fouled inside and/or outside?  
Signs of insulation breakdown?
- \* Check interference-suppression resistors, ignition cables and spark plugs.
- \* When connecting the ignition cables, note the numbers of the cylinders.  
Do not forget hood and screening cover.



High-voltage distributor  
1 to 4 = Ignition cables  
ZS = High-voltage lead to ignition coil

Return to trouble-shooting chart B03

D03

<==>

D04

<==>

# TROUBLE-SHOOTING PROGRAM (13)

## Check spark-advance angle

Connect motortester. Bring engine to operating temperature (engine-oil temperature min. 80° C). Switch off all electrical equipment. Flash timing light at ignition mark (top picture)

1. At idle speed, disconnect plug from temperature sensor (engine) (bottom picture) and raise engine speed 2000...2500 min<sup>-1</sup>.

SET VALUE for basic value:  
see brief instructions

2. Reconnect plug to temperature sensor (engine) and set engine speed to 3000 min<sup>-1</sup>

Deduct the basic value from the indicated spark-advance angle, and determine the advance.

SET VALUE for advance:  
see brief instructions

Set values obtained?

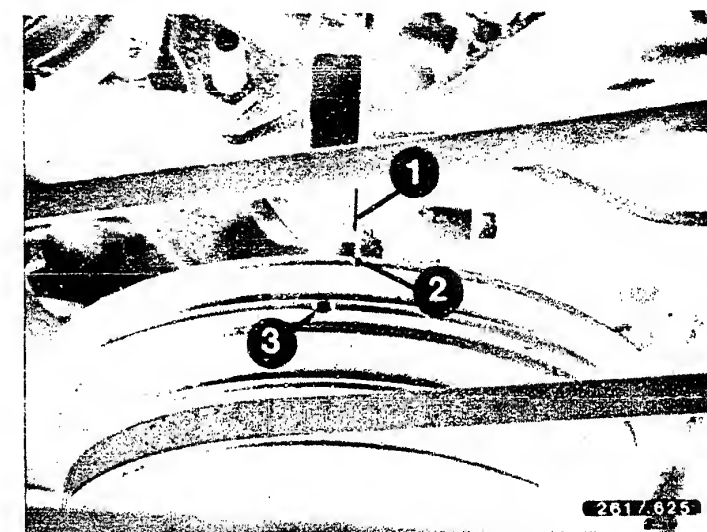
Return to trouble-shooting chart B03

- \* Idle speed correct?
- \* Temperature sensor (engine) and lead O.K.?
- \* Check air-flow sensor and temperature sensor (air).
- \* Re-set basic value

SETTING VALUE:  
4°...6° crankshaft

and repeat test as under 2.

- \* If advance still not within tolerance, replace control unit.



- 1 = Reference edge for ignition adjustment
- 2 = Ignition mark (5° crankshaft)
- 3 = TDC mark

Arrow = Plug connector of temperature sensor (engine)



# TROUBLE-SHOOTING PROGRAM (14)

Check idle speed:

Connect motortester according to operating instructions.

Engine at operating temperature; switch off electrical equipment.

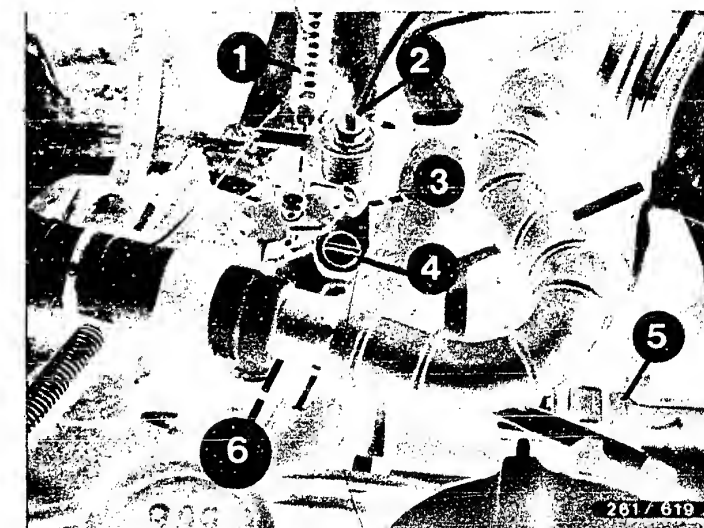
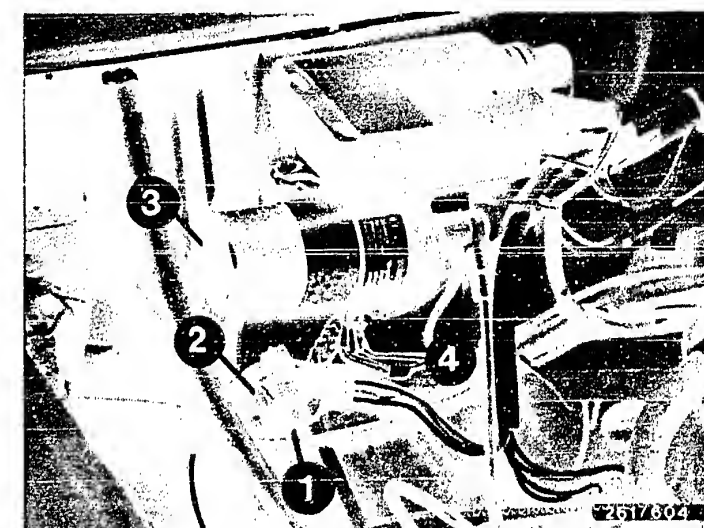
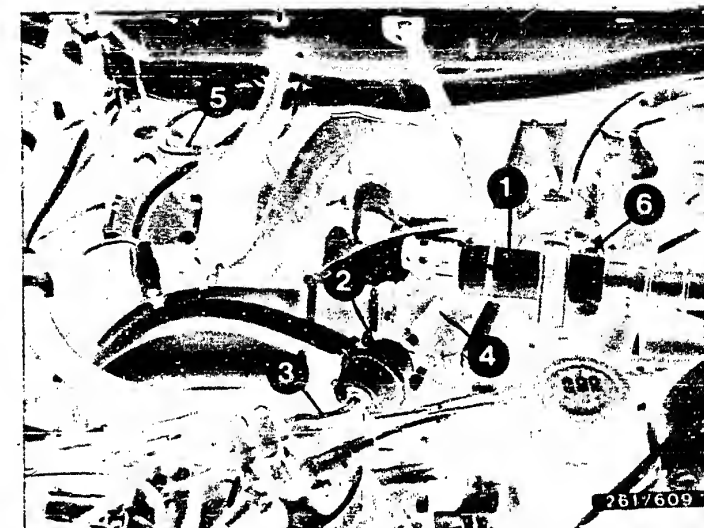
Render idle-speed control and lambda closed-loop control inoperative by taking apart the appropriate plug connectors (top picture - Item 5 and center pictures - Item 2).

SET VALUE:  
see brief instructions

Set value obtained?

N>

- \* Idle contact in throttle-valve switch must be closed -> check.
  - \* Check throttle cable.
  - \* Throttle valve correctly adjusted?
  - \* Air-intake system leak-tight?
  - \* Possibility of adjustment at idle-adjusting screw (bottom picture):
- 1 = Throttle cable  
2 = Throttle-valve shaft  
3 = Throttle-valve stop screw (not visible)  
4 = Idle-adjusting screw  
5 = Plug connector to throttle-valve switch  
6 = Throttle-valve switch (at bottom on throttle-valve assembly)
- \* For further possible faults see trouble-shooting chart.



Continued on next picture page



# TROUBLE-SHOOTING PROGRAM (14) CONTINUED ( 1)

Check exhaust gas (CO):

Connect exhaust gas analyzer.

In vehicles with catalytic converter, at test point (top picture - Item 2).

Engine at operating temperature; switch off electrical equipment; pinch off hose to active-carbon container (center picture - Item 4) and take apart lambda-sensor plug connector (bottom picture - Item 2).

Operate engine at idle speed.

SET VALUES:  
see brief instructions

Set values O.K.?

N>

\* Possibility of mixture adjustment (CO) at bypass in air-flow sensor (center picture - Item 2).

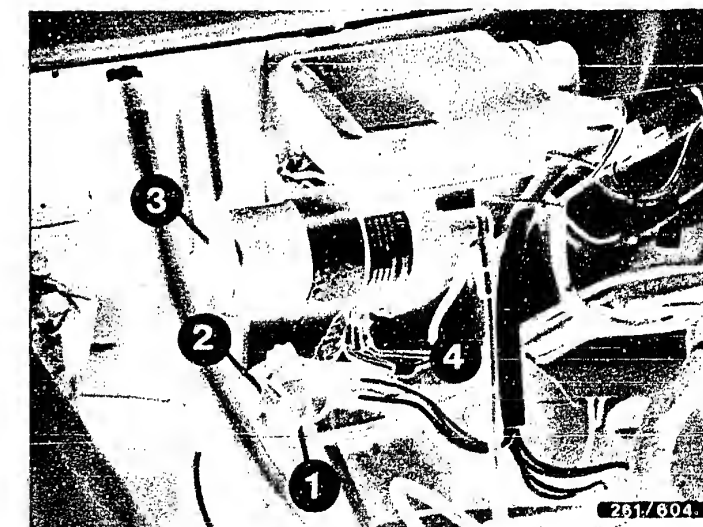
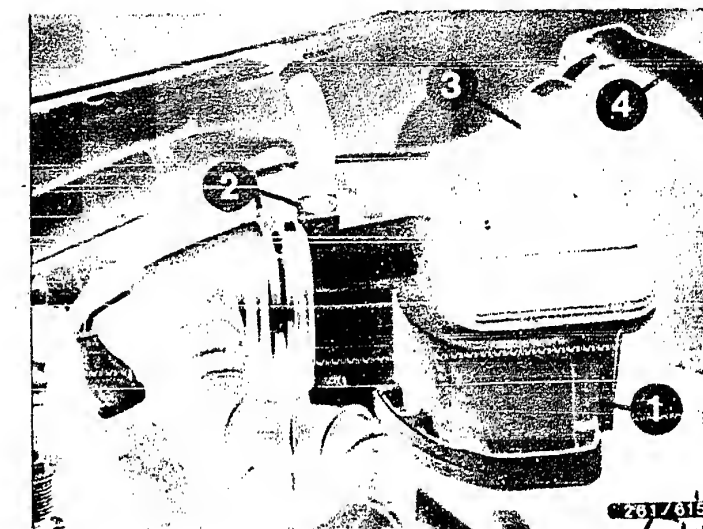
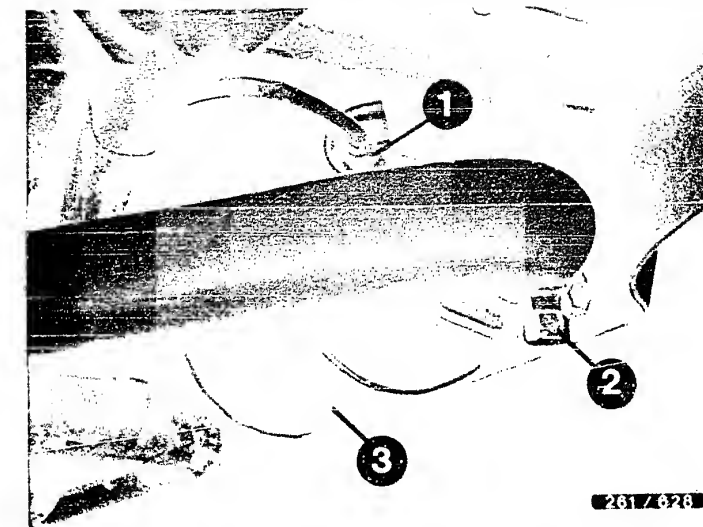
Remove plug in air-flow sensor:

Turning adjusting screw clockwise → CO rises

Turning adjusting screw counterclockwise → CO falls

Insert new plug.

\* For further possible faults see trouble-shooting chart.



Return to trouble-shooting chart B03

# TROUBLE-SHOOTING PROGRAM (15)

V

## Check overrun cutoff

N>

Connect the two-pole test lead 1 684 463 093 between an injection valve and its connector.

Connect motortester (special input) to test lead.

Black clamp to vehicle ground.

Connect red clamp to one of the two connections of the test lead.

### Caution:

The free connection of the test lead must not come into contact with ground.

Raise engine speed to 3000 min<sup>-1</sup>. Injection signals visible (top picture).

Release accelerator suddenly.

### SET VALUE:

As engine speed falls, injection signals are suppressed and are reinstated above the idle speed.

Set value O.K.?

Y

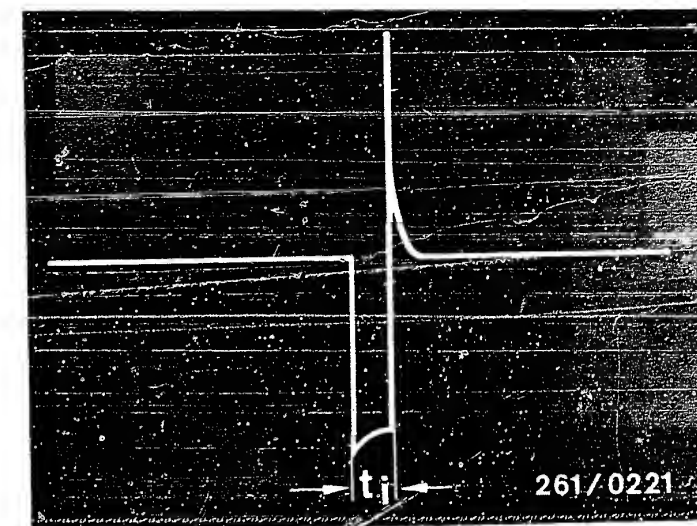
V

Return to trouble-shooting chart B03

\* Repeat test.

\* Check idle contact in throttle-valve switch.

\* Control unit defective.



Injection signal

$t_i$  = Duration of injection

## TROUBLE-SHOOTING PROGRAM (16)

Check lambda closed-loop ctrl.(I)

N>

Repair defective lead/plug.

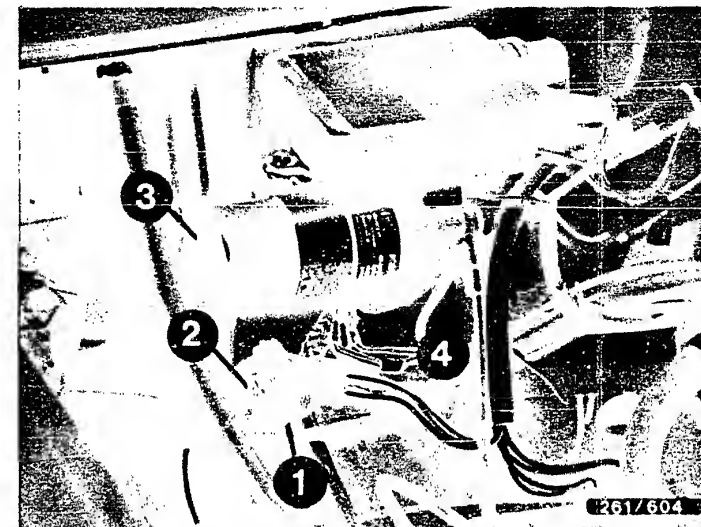
\* Check lead from control unit term.2 to lambda sensor for open circuit with ohmmeter. Check plug connector (picture - Item 2) for corrosion and loose contact.

\* Check lead from control unit term.2 to lambda sensor for short circuit contact with ground with ohmmeter. Watch for worn insulation and loose contacts.

\* Lead from control unit to lambda sensor has connection to live lead (short circuit to battery voltage due to insulation damage).

Watch for worn insulation and worn contact.

Leads and plug O.K.?



1 = Plug for lambda-sensor heating

2 = Lambda-sensor plug connector

Continued on next picture page

V

Check lambda closed-loop ctrl.(II)

N&gt;

- \* Connect CO analyzer upstream of catalytic converter (top picture - Item 2).

If necessary, use screw-type sleeve V.A.G 1506

Engine at operating temperature.

Exhaust system in good condition (no leaks).

- \* Measure exhaust at idle and make note of CO value.

- \* Disconnect air hose from pressure regulator and seal off.

CO concentration should rise briefly and drop back to the previous value.

O.K.?

V

Return to trouble-shooting chart B03

Check control unit:

- \* Upper limit of lambda closed-loop control: take apart sensor plug connector (bottom picture - Item 2) and lay control-unit end against ground.

SET VALUE:

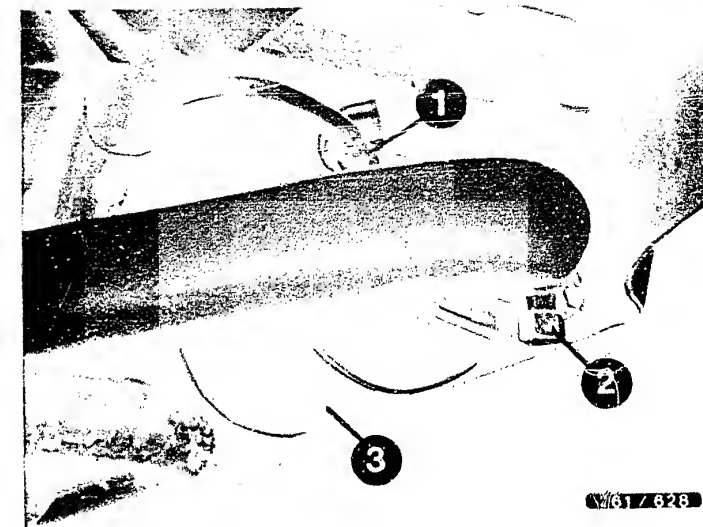
CO concentration rises (do this quickly out of consideration for the catalytic converter).

- \* Lower limit of lambda closed-loop control: lay control-unit end of sensor plug connector against approx. + 2 V voltage (e.g. use 1.5 V monocrystal, connecting the negative pole to vehicle ground).

SET VALUE:

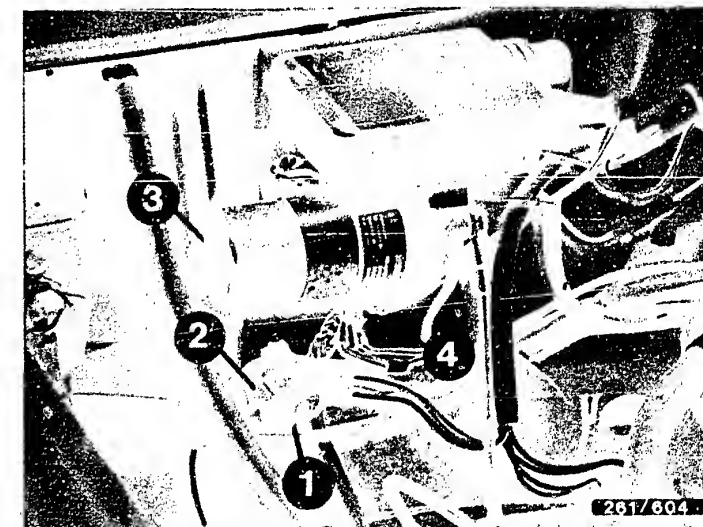
CO concentration falls (rough engine idle).

If set values not obtained, control unit - otherwise lambda sensor - defective -> replace.



1 = Lambda sensor  
2 = CO test point  
3 = Catalytic converter

1 = Plug for lambda-sensor heating  
2 = Lambda-sensor plug connector



## PLUG CONNECTORS FOR JETRONIC COMPONENTS

28  
VDT-I-280/111 En  
11.1984

Parts sets supersedes Ed. 11.1982

Parts sets are available for the replacement  
of Jetronic plug connectors, comprising:

- \* Plug-connector housing
- \* Protective cap (rubber sleeve)
- \* Contact springs

These parts are listed on microcard EE...\*

- \* See microcards EE00, and 0 280 ..

- \* Plug, black, 2-pole,  
parts set 1 287 013 002 cable connector  
in conjunction with socket, 2-pole.

- \* Socket, black, 2-pole,  
parts set 1 287 013 001 for e.g.

Temperature sensor 0 280 130 0..  
Auxiliary-air device 0 280 140 ..  
Thermo-time switch 0 280 130 2..  
Start valve 0 280 170 ..  
Warm-up regulator 0 438 140 ..

- \* Socket, gray, 2-pole,  
parts set 1 287 013 003 for:

Injection valve 0 280 156 ..

- \* Socket, black, 3-pole  
parts set 1 237 000 039 for:

Throttle-valve switch 0 280 120 ..

- \* Socket, black, 5-pole,  
parts set 1 287 013 006 for:

Air-flow sensor 0 280 20. .. (LE version)

- \* Socket, black, 6-pole,  
parts set 1 287 013 004 for

Air-flow sensor 0 280 200 ..

- \* Socket, black, 7-pole,  
parts set 1 287 013 005 for:

Air-flow sensor 0 280 20. ..  
Air-mass sensor 0 280 211 ..

- \* Wiring-harness plug connector, black, 25-pole,  
parts set 1 287 013 009 for:

Control unit 0 280 0..

- \* Wiring-harness plug connector, black, 35-pole,  
parts set 1 287 013 008 for:

Control unit 0 280 0..

The contact springs (minitimers) are also  
available individually under part number  
1 284 477 026.

The plug-connector housings are available  
only in the stated colors.

Published by:

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Division KH  
Technical After-Sales Service (KH/VKD 2)  
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